

**Red River Coal Company  
Benthic Macroinvertebrate Survey  
Conducted on March 28, 2012**

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**May 16, 2012**

## **EXECUTIVE SUMMARY**

Biological Monitoring, Inc. (BMI) performed a stream survey in the South Fork Pound River Watershed for the Red River Coal Company. The purpose of this survey was to conduct instream biological assessments as outlined in the Division of Mine Land Reclamation Guidance Memorandum 32-10 Revised. A total of five (5) stations were sampled.

The Virginia Stream Condition Index (VASCI) protocol was used for instream biological surveys. All biological sampling was performed in accordance with the Virginia Department of Game and Inland Fisheries' scientific collection permit requirements. Instream sampling for chemical analyses were performed concurrently. The instream samples were analyzed for chemical parameters as per permit requirements.

On March 28<sup>th</sup>, 2012, samples were collected following BMI's Biological Monitoring Program Quality Assurance Project Plan for Wadeable Streams and Rivers. Ephemeroptera, Plecoptera, and Trichoptera were identified to the generic level. All other organisms were identified to the lowest practicable taxonomic level. The US EPA's Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers was used for sampling macroinvertebrate populations and performing habitat assessments.

The analyses of the spring 2012 survey data yielded VASCI scores ranging from 13.76 to 54.87. Using the Virginia Department of Environmental Quality devised scale, these stations were classified in the Severe Stress to Stress Aquatic Life Use (ALU) Tiers. The five monitoring stations habitat assessment scores ranged from 138 (sub-optimal) to 162 (optimal). For comparative purposes, data from three previous sampling events are presented within this report. The limited data accumulated to date lacks the resolution to determine cause and effect relationships.

## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>I</b>
<b>TABLE OF CONTENTS .....</b>	<b>II</b>
<b>LIST OF FIGURES &amp; TABLES.....</b>	<b>III</b>
LIST OF FIGURES .....	III
LIST OF TABLES .....	III
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
<b>2.0 METHODS AND MATERIALS .....</b>	<b>2</b>
2.1 GENERAL .....	2
2.2 STATION LOCATION .....	2
2.3 MACROINVERTEBRATE SAMPLING & ASSESSMENT .....	4
2.3.1 Sampling & Identification.....	4
2.3.2 Macroinvertebrate Data Assessment .....	5
2.4 HABITAT ASSESSMENT .....	7
2.5 WATER QUALITY ASSESSMENT .....	9
<b>3.0 RESULTS .....</b>	<b>11</b>
3.1 STATION LOCATION .....	11
3.2 MACROINVERTEBRATE MONITORING DATA .....	11
3.2.1 Virginia Stream Condition Index Metrics.....	11
3.2.2 Virginia Stream Condition Index Scores .....	13
3.3 HABITAT ASSESSMENT .....	14
3.4 WATER QUALITY ASSESSMENT .....	16
<b>4.0 DISCUSSION .....</b>	<b>18</b>
4.1 STATION LOCATION .....	18
4.2 MACROINVERTEBRATE DATA .....	18
4.3 HABITAT ASSESSMENT .....	20
4.4 WATER QUALITY ASSESSMENT .....	21
<b>5.0 LITERATURE CITED .....</b>	<b>22</b>
<b>APPENDIX A: STATION PHOTOGRAPHS AND DESCRIPTIONS.....</b>	<b>A</b>
<b>APPENDIX B: MONITORING DATA .....</b>	<b>B</b>

## LIST OF FIGURES & TABLES

### List of Figures

FIGURE 1. MAP OF THE RED RIVER COAL COMPANY MONITORING STATIONS .....	3
FIGURE 2. PHOTOS OF SFP-1 .....	A-1
FIGURE 3. PHOTOS OF SFP-2.....	A-2
FIGURE 4. PHOTOS OF SC-1 .....	A-3
FIGURE 5. PHOTOS OF RC-1 .....	A-4
FIGURE 6. PHOTOS OF GF-1 .....	A-5

### List of Tables

TABLE 1. RED RIVER COAL COMPANY MONITORING STATION ATTRIBUTES.....	3
TABLE 2. VASCI METRICS AND EXPECTED RESPONSES.....	6
TABLE 3. HABITAT ASSESSMENT PARAMETERS .....	9
TABLE 4. CHEMICAL PARAMETERS FOR USED FOR ANALYSIS .....	10
TABLE 5. RED RIVER COAL COMPANY STATION VASCI METRICS FOR SPRING 2012. ....	12
TABLE 6. RED RIVER COAL COMPANY STATION VASCI METRICS FOR FALL 2011.....	12
TABLE 7. RED RIVER COAL COMPANY STATION VASCI METRICS FOR SPRING 2011. ....	12
TABLE 8. RED RIVER COAL COMPANY STATION VASCI METRICS FOR FALL 2010.....	12
TABLE 9. RED RIVER COAL COMPANY MONITORING STATION VASCI SCORING SPRING 2012.....	13
TABLE 10. RED RIVER COAL COMPANY MONITORING STATION VASCI SCORING FALL 2011.....	13
TABLE 11. RED RIVER COAL COMPANY MONITORING STATION VASCI SCORING SPRING 2011.....	13
TABLE 12. RED RIVER COAL COMPANY MONITORING STATION VASCI SCORING FALL 2010.....	14
TABLE 13. RED RIVER COAL COMPANY MONITORING STATION RBP HABITAT SCORING SPRING 2012. ....	14
TABLE 14. RED RIVER COAL COMPANY MONITORING STATION RBP HABITAT SCORING FALL 2011. ....	15

TABLE 15. RED RIVER COAL COMPANY MONITORING STATION RBP HABITAT SCORING SPRING 2011. ....	15
TABLE 16. RED RIVER COAL COMPANY MONITORING STATION RBP HABITAT SCORING FALL 2010. ....	16
TABLE 17. RED RIVER COAL COMPANY WATER QUALITY ANALYSES SPRING 2012.....	16
TABLE 18. RED RIVER COAL COMPANY WATER QUALITY ANALYSES FALL 2011 .....	17
TABLE 19. RED RIVER COAL COMPANY WATER QUALITY ANALYSES SPRING 2011 .....	17
TABLE 20. RED RIVER COAL COMPANY WATER QUALITY ANALYSES FALL 2010 .....	17
TABLE 21. COMPARISON OF RECENT VASCI SCORES .....	19
TABLE 22. COMPARISON OF RECENT ALU TIERS .....	19
TABLE 23. COMPARISON OF RECENT HABITAT SCORES .....	20
TABLE 24. COMPARISON OF RECENT HABITAT SCORE CLASSIFICATIONS .....	21

## **1.0 INTRODUCTION**

Biological Monitoring, Inc. (BMI) specializes in issues of water quality. Since 1980, BMI has been providing expertise in aquatic toxicology and risk assessment. Highly motivated and academically trained scientists at BMI work closely with clients to create practical solutions to environmental problems. BMI has maintained a commitment to the research and development of aquatic biomonitoring and toxicological concepts resulting in leading edge technologies and applications.

BMI interacts with regulatory agencies on behalf of its clients to solve specific environmental problems associated with water quality and toxicological regulations and permit compliance. With its main facilities located in Blacksburg, Virginia, BMI focuses on the development and application of procedures to create feasible solutions that balance the need for environmental protection and continued economic development.

BMI performed a stream survey for the Red River Coal Company in the South Fork Pound River Watershed located in Wise County. The purpose of this survey was to conduct instream biological assessments as outlined in the Division of Mine Land Reclamation (DMLR) Guidance Memorandum 32-10 Revised (DMLR 2011). The present report provides the methods utilized and the results obtained from the March 28<sup>th</sup>, 2012 sampling event. For comparative purposes, data from three previous sampling events (November 16<sup>th</sup>, 2010, April 15<sup>th</sup>, 2011 and November 1<sup>st</sup>, 2011) are also reported.

## **2.0 METHODS AND MATERIALS**

### **2.1 General**

On March 28<sup>th</sup>, 2012, samples were collected following BMI's Biological Monitoring Program Quality Assurance Project Plan for Wadeable Streams and Rivers (QAPP) (BMI 2012). The Virginia Stream Condition Index (VASCI) protocol was used for this instream biological survey (Tetra Tech 2003). The US EPA's Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers (RBP) was used for sampling macroinvertebrate populations and performing habitat assessments (USEPA 1999). Qualitative habitat assessments were conducted at each bioassessment site by trained and experienced individuals. This survey was conducted in accordance with the DMLR Guidance Memorandum No. 32-10 Revised (DMLR 2011). Prior to initiation of this survey, BMI consulted with DMLR personnel to determine the specific monitoring data and locations necessary and appropriate for this project.

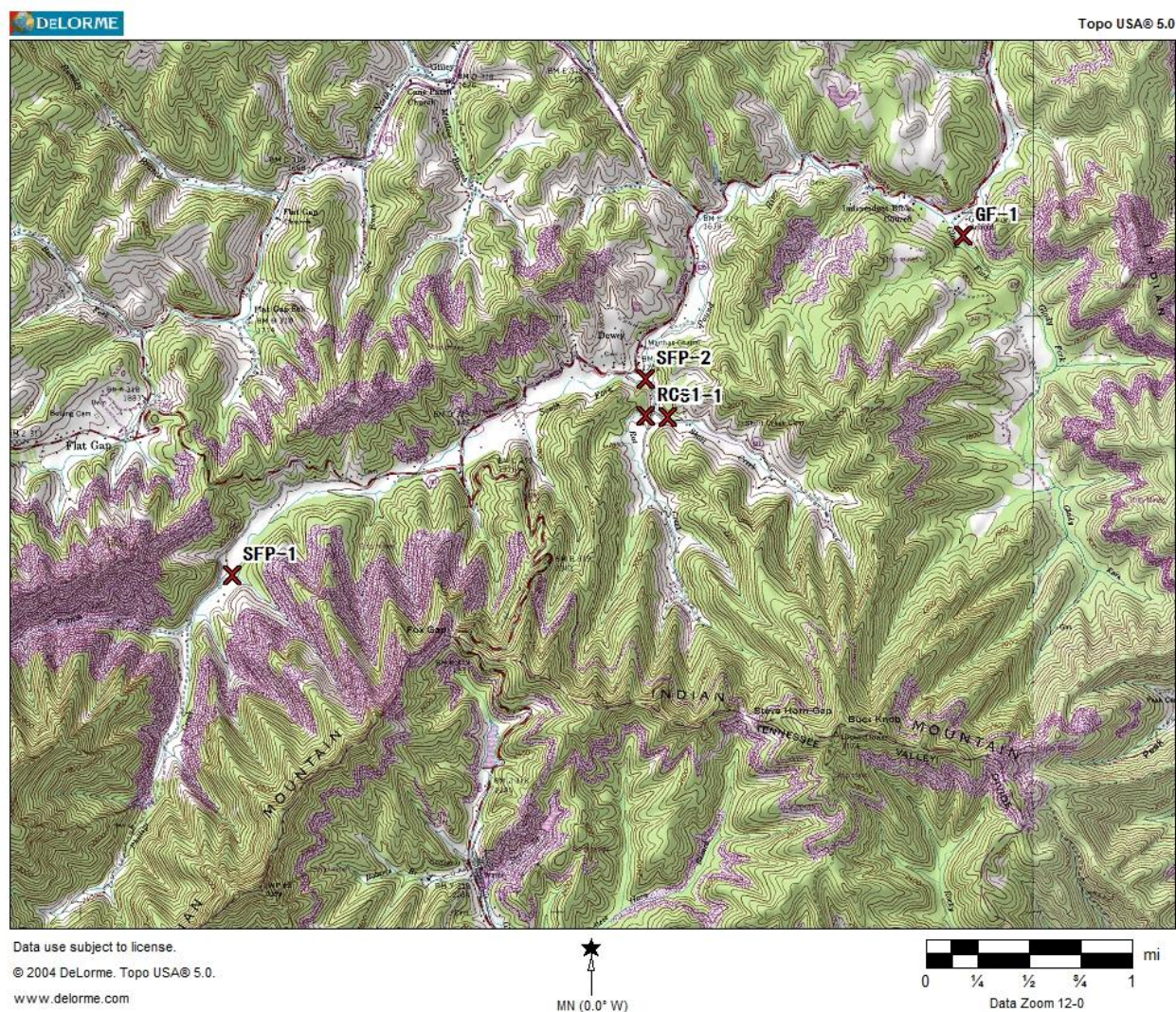
### **2.2 Station Location**

Five sampling stations were selected by a representative from DMLR. The stations were located in Wise County, Virginia and within the South Fork Pound River Watershed. Latitude and longitude coordinates were recorded at each station using a Garmin® Global Positioning System portable unit (GPSMAP 60 CSX). Table 1 summarizes the monitoring station attributes. Figure 1 provides a map of the area and the locations of each benthic station.



**Table 1.** Red River Coal Company Monitoring Station Attributes.

Station ID	Location Summary	Latitude	Longitude
SFP-1	Most upstream station in South Fork Pound River	37° 03' 57.0"	82° 41' 40.6"
SFP-2	South Fork Pound River downstream of confluence of Rat Creek	37° 04' 45.9"	82° 39' 30.8"
SC-1	Mouth of Short Creek	37° 04' 36.9"	82° 39' 29.4"
RC-1	Mouth of Rat Creek	37° 04' 36.3"	82° 39' 27.1"
GF-1	Mouth of Glady Fork	37° 05' 23.1"	82° 37' 51.4"



**Figure 1.** Map of the Red River Coal Company Monitoring Stations



## **2.3 Macroinvertebrate Sampling & Assessment**

### **2.3.1 Sampling & Identification**

All biological sampling was performed in accordance with the Virginia Department of Game and Inland Fisheries' scientific collection permit requirements. Macroinvertebrates were collected at each benthic station following the single habitat approach (riffle-run) as presented in the QAPP (BMI 2012). Samples were collected using a semi-quantitative approach.

Four samples were collected at each station using a 0.50 m wide rectangular kick-net having a 600 µm mesh size. Each sample was collected by first placing the net on the bottom downstream of the 0.50 m<sup>2</sup> area to be sampled. Where appropriate, large rocks and debris were brushed off into the net and removed. The area to be sampled was then vigorously kicked for approximately 20 seconds. For each of the monitoring stations, the four samples were rinsed, composited, placed in a labeled container, and preserved in 70% ethanol. Sample information was recorded on a BMI Sample Chain of Custody Form and returned to BMI's laboratory for enumeration and identification.

Organisms were separated from the debris in the laboratory. Subsampling was performed on each sample to a standard count of  $110 \pm 10\%$ . The taxonomic orders Ephemeroptera, Plecoptera, and Trichoptera were identified to the generic level. All other organisms were identified to the lowest practicable taxonomic level. Organism identification utilized the appropriate taxonomic keys (Merritt and Cummins 2008). All organisms from this study will be retained for a period of at least two years.

### 2.3.2 Macroinvertebrate Data Assessment

Macroinvertebrate data were analyzed using *A Stream Condition Index for Virginia Non-Coastal Streams* (Tetra Tech 2003). This VASCI was developed from an analysis of data collected by the Virginia DEQ from 1994 to 1998 and 1999 to 2002. Using these data, VASCI designated statewide reference values were determined for each of the following six metrics of community structure:

- **Total Number of Taxa** measures the total number of distinct taxa and, therefore, is representative of the diversity within a sample. High diversity is a strong indicator of stream health and ability to sustain populations. This metric value is expected to decrease in response to increased perturbation.
- **Total Number of EPT Taxa** is a measure of the total number of distinct taxa within the Orders Ephemeroptera, Plecoptera, and Trichoptera. These orders include the mayflies, stoneflies, and caddis flies, respectively. Organisms in these three orders have low tolerances to perturbation. As a result, the value of the metric is expected to decrease in response to increasing perturbation.
- **Percent EPT** is the percentage of individual Ephemeroptera, Plecoptera, and Trichoptera organisms within a sample. This metric is calculated by dividing the number of EPT organisms by the total number of sample organisms. This metric indicates the relative abundance of these sensitive orders within the stream community. The value of this metric is expected to decrease in response to increasing perturbation.
- **Percent Chironomidae** is the percent individual organisms of the Family Chironomidae within a sample. The metric is calculated by dividing the number of Chironomidae organisms by the total number of sample organisms. Family Chironomidae, the midges, are tolerant to perturbation and their relative abundance tends to increase in impacted streams. As a

result, the value of this metric is expected to increase in response to increasing perturbation.

- **Percent Two Dominant Taxa** is the percentage of total individuals in the two taxa with the greatest number of organisms. The metric is calculated by adding the number of organisms present in the two largest taxa. Dividing this sum by the total number of organisms yields the relative abundance of the two dominant taxa. Samples with populations concentrated into a few taxa may be an indication of impact. This metric is expected to increase in response to increasing perturbation.
- **Hilsenhoff Biotic Index (HBI)** was originally designed to evaluate organic pollution by utilizing tolerance values to weight taxa abundance. The resulting HBI value is an estimation of overall pollution level. The metric is expected to increase in response to increasing perturbation.

The VASCI metrics and their expected response to perturbation are summarized in Table 2.

**Table 2.** VASCI Metrics and Expected Responses.

Metric	Expected Response
Total Number of Taxa	Decrease
Total Number of EPT Taxa	Decrease
Percent EPT	Decrease
Percent Chironomidae	Increase
Percent 2 Dominant Taxa	Increase
Hilsenhoff Biotic Index	Increase

VASCI scores for each of the five monitoring stations were calculated by dividing each station's metric values by the corresponding VASCI statewide reference values. This yielded a percentage score for each metric relative to the statewide reference condition. If the percentage score of any individual metric was greater than 100, the score was

truncated to 100. The six resulting values were then averaged to arrive at the VASCI score for each station.

## 2.4 Habitat Assessment

Habitat assessments were performed at each benthic station where macroinvertebrates were collected. These assessments were performed as per the RBP (USEPA 1999). Ten habitat parameters were assessed, each receiving a score of 0 – 20. A description of each of the habitat parameters follows:

- **Epifaunal Substrate / Available Cover** rate the availability of structures in the stream that can be utilized as refuge, spawning, and feeding sites by macroinvertebrates. Examples of such structures would include boulders, cobble, undercut banks, roots, logs and branches. The availability of cover can be a limiting factor on stream diversity and abundance.
- **Embeddedness** rate the degree to which coarse substrate such as gravel; cobble and boulders are sunken into the sand, silt and mud substrate of the stream bottom. Embeddedness is the result of sediment movement and deposition. Increased embeddedness reduces the available refuge, feeding and spawning sites available to macroinvertebrates resulting in lower diversity and abundance.
- **Velocity / Depth Regimes** gauge the presence or absence of four velocity-depth patterns. These patterns are slow-deep, slow-shallow, fast-deep, and fast-shallow. Ideally, all four patterns should be present to best provide a stable diverse stream community.
- **Sediment Deposition** rates the degree to which new sediment has accumulated in pools, point bars and islands. Sediment deposition may be an indicator of an unstable environment and lowered diversity.

- **Channel Flow Status** rates the degree to which water fills the stream channel. Channel flow status may be affected by obstructions, diversions or widening of the stream channel. As less of the channel is filled by water, the amount of suitable substrate is also reduced.
- **Channel Alteration** rate the degree to which the shape of the stream channel has been altered. Alterations may include bridges, roads, diversion channels, channel straightening, artificial embankments, riprap, dams, weirs, and other instream structures. Channel alteration often results in scouring and loss of available habitat.
- **Frequency of Riffles (or Bends)** rates the presence of quality riffle or sinuous habitat. Riffles and sinuous streams provide quality habitat for stable, diverse communities.
- **Bank Stability** indicates the degree to which banks have eroded or may erode. Eroded banks are a sign of sediment movement and deposition, which leads to reduced epifaunal habitat. Unstable banks may also point to poor vegetative cover.
- **Bank Vegetative Protection** gauges the extent of vegetative protection at the stream bank and the nearby riparian zone. Bank vegetation plays a vital role in erosion control, nutrient uptake, stream shading, and food supply.
- **Riparian Vegetative Zone Width** measures the extent of natural vegetation from the stream through the riparian zone. Wide vegetative zones provide pollution buffering, erosion control, habitat, nutrient uptake and nutrient input. These beneficial contributions can be impaired by commercial and residential development, roads, pastures, actively worked fields, etc.

Table 3 identifies each of the ten Habitat Assessment Parameters and their range of scores. Scores for each parameter were recorded on Habitat Assessment Field Log Sheets (USEPA 1999). The habitat assessment score for each station was calculated by adding the score for each parameter yielding a station total. The highest attainable score was 200. The actual habitat assessment process involves rating the ten parameters as optimal (>153), suboptimal (101-153), marginal (46-100), or poor (<45).

**Table 3.** Habitat Assessment Parameters

Parameter	Description	Scoring
1	Epifaunal Substrate / Available Cover	0-20
2	Embeddedness	0-20
3	Velocity / Depth Regime	0-20
4	Sediment Deposition	0-20
5	Channel Flow Status	0-20
6	Channel Alteration	0-20
7	Frequency of Riffles or Bends	0-20
8	Bank Stability	Left 0-10
		Right 0-10
9	Vegetative Protection	Left 0-10
		Right 0-10
10	Riparian Vegetative Zone Width	Left 0-10
		Right 0-10

## 2.5 Water Quality Assessment

Prior to any field data collections, all handheld meters were calibrated. Conductivity ( $\mu\text{S}$ ), pH, temperature ( $^{\circ}\text{C}$ ) and flow were recorded at each of the five sample stations. Conductivity, pH and Temperature were all recorded using a Hanna Instruments Portable pH/EC/TDS/Temperature Meter (HI 991300). Stream velocities were measured using a Global Water Flow Probe FP101. Stream discharge was calculated using the Mid-Section Velocity Area Method (Buchanan 1969). Instream sampling for additional analyses were performed concurrent to the biological sampling. These samples were taken to Environmental Monitoring, Inc. of Norton, VA for subsequent analysis. The analysis conducted for each station included the parameters listed in Table 4.



**Table 4.** Chemical parameters for used for analysis

Flow (gpm)	Manganese (mg/L)	Total Arsenic (µg/L)
Temperature (°C)	Magnesium (mg/L)	Total Beryllium (µg/L)
pH (STD units)	Total Acidity (mg/L)	Total Cadmium (µg/L)
TSS (mg/L)	Total Alkalinity (mg/L)	Total Chromium (µg/L)
Specific Conductance (µS/cm)	Bicarbonate Alkalinity (mg/L)	Total Copper (µg/L)
TDS (mg/L)	Carbonate Alkalinity (mg/L)	Total Lead (µg/L)
Sulfates (mg/L)	Hardness (mg/L)	Total Mercury (µg/L)
Chlorides (mg/L)	Total Zinc (µg/L)	Total Nickel (µg/L)
Aluminum (mg/L)	Total Antimony (µg/L)	Total Selenium (µg/L)
Iron (mg/L)	Total Silver (µg/L)	Total Thallium (µg/L)
Total Cobalt (µg/L)	Nitrate (mg/L)	Total Barium (µg/L)
Total Cyanide (µg/L)	Nitrite (mg/L)	Total Boron (µg/L)
Total Phenols (µg/L)	Diss. Organic Carbon (mg/L)	

## **3.0 RESULTS**

### **3.1 Station Location**

Since they were selected by DMLR personnel, the five monitoring stations were assumed to be representative of the appropriate outfalls in this watershed. Station attributes, including latitudes and longitudes, are presented in Table 1 and depicted in Figure 1. Station photographs and descriptions are presented in Appendix A. Flows were adequate for sampling at all stations.

### **3.2 Macroinvertebrate Monitoring Data**

#### **3.2.1 Virginia Stream Condition Index Metrics**

The VASCI metric values for the Red River Coal Company monitoring stations sampled in March 2012 are summarized in Table 5. The Number of Taxa ranged from 5 (SFP-1, SFP-2, and RC-1) to 12 (GF-1) and the Number of EPT Taxa ranged from 1 (SFP-1) to 8 (GF-1). The Percent EPT (less Hydropsychidae) ranged from 0 (SFP-1) to 70.09 (GF-1) and Percent Chironomidae ranged from 19.66 (GF-1) to 89.09 (SFP-1). The remaining two metrics, Percent Two Dominant Taxa and Hilsenhoff Biotic Index (HBI) had ranges of 81.20 (GF-1) to 94.55 (SFP-1) and 3.03 (GF-1) to 5.95 (SFP-1), respectively. Identification and enumeration data for the March 2012 sampled stations are presented in Appendix B.

Tables 6, 7 and 8 present the metric values from Fall and Spring 2011 and Fall 2010 sampling season.

**Table 5.** Red River Coal Company Station VASCI Metrics for Spring 2012.

Station ID	Number of Taxa	Number of EPT Taxa	Percent EPT (less Hyd.)	Percent Chiron.	Percent Two Dom. Taxa	HBI Score
SFP-1	5	1	0	89.09	94.55	5.95
SFP-2	5	3	7.92	86.14	90.10	5.68
SC-1	10	6	15.60	72.48	81.65	5.22
RC-1	5	3	1.98	88.12	94.06	5.89
GF-1	12	8	70.09	19.66	81.20	3.03

**Table 6.** Red River Coal Company Station VASCI Metrics for Fall 2011.

Station ID	Number of Taxa	Number of EPT Taxa	Percent EPT (less Hyd.)	Percent Chiron.	Percent Two Dom. Taxa	HBI Score
SFP-1	5	1	0	67.24	82.76	5.98
SFP-2	7	4	21.85	60.50	79.83	4.92
SC-1	10	6	35.29	40.20	67.65	3.90
RC-1	8	3	14.85	67.33	79.21	5.27
GF-1	9	5	56.30	13.45	63.03	3.15

**Table 7.** Red River Coal Company Station VASCI Metrics for Spring 2011.

Station ID	Number of Taxa	Number of EPT Taxa	Percent EPT (less Hyd.)	Percent Chiron.	Percent Two Dom. Taxa	HBI Score
SFP-1	4	0	0	46.53	97.03	5.96
SFP-2	6	2	4.81	90.38	95.19	5.74
SC-1	3	1	9	90	99	5.44
RC-1	3	1	0	97.30	99.10	5.97
GF-1	7	4	67.33	5.94	83.17	1.82

**Table 8.** Red River Coal Company Station VASCI Metrics for Fall 2010.

Station ID	Number of Taxa	Number of EPT Taxa	Percent EPT (less Hyd.)	Percent Chiron.	Percent Two Dom. Taxa	HBI Score
SFP-1	6	1	0	55.56	87.65	6.06
SFP-2	10	5	29.79	23.40	56.38	4.57
SC-1	10	5	34.75	50.85	66.95	4.28
RC-1	14	6	9.30	46.51	67.44	5.47
GF-1	15	8	68.63	5.88	44.12	2.82

### 3.2.2 Virginia Stream Condition Index Scores

VASCI scores were calculated for all monitoring stations. Table 9 presents a summary of the VASCI scores from the Red River Coal Company monitoring stations for March 2012. VASCI scores calculated for the Red River Coal Company monitoring stations ranged from 13.76 (SFP-1) to 54.87 (GF-1).

Tables 10, 11 and 12 present VASCI scores from Fall and Spring 2011 and Fall 2010 sampling season.

**Table 9.** Red River Coal Company Monitoring Station VASCI Scoring Spring 2012.

Station ID	Number of Taxa	Number of EPT Taxa	Percent EPT	Percent Chiron.	Percent Two Dom Taxa	HBI Score	VASCI Score
SFP-1	22.73	9.09	0	10.91	7.88	59.49	<b>13.76</b>
SFP-2	22.73	27.27	22.25	13.86	14.31	63.48	<b>20.49</b>
SC-1	45.45	54.55	43.81	27.52	26.52	70.29	<b>33.52</b>
RC-1	22.73	27.27	5.56	11.88	8.58	60.43	<b>17.06</b>
GF-1	54.55	72.73	196.87	80.34	27.17	102.44	<b>54.87</b>

**Table 10.** Red River Coal Company Monitoring Station VASCI Scoring Fall 2011.

Station ID	Number of Taxa	Number of EPT Taxa	Percent EPT	Percent Chiron.	Percent Two Dom Taxa	HBI Score	VASCI Score
SFP-1	22.73	9.09	0	32.76	24.92	59.08	<b>18.57</b>
SFP-2	31.82	36.36	61.37	39.50	29.14	74.64	<b>34.10</b>
SC-1	45.45	54.55	99.14	59.80	46.75	89.68	<b>50.02</b>
RC-1	36.36	27.27	41.72	32.67	30.05	69.60	<b>29.71</b>
GF-1	40.91	45.45	158.15	86.55	53.43	100.72	<b>53.29</b>

**Table 11.** Red River Coal Company Monitoring Station VASCI Scoring Spring 2011.

Station ID	Number of Taxa	Number of EPT Taxa	Percent EPT	Percent Chiron.	Percent Two Dom Taxa	HBI Score	VASCI Score
SFP-1	18.18	0	0	53.47	4.29	59.41	<b>16.92</b>
SFP-2	27.27	18.18	13.50	9.62	6.95	62.64	<b>17.27</b>
SC-1	13.64	9.09	25.28	10	1.45	67.06	<b>15.81</b>
RC-1	13.64	9.09	0	2.70	1.30	59.22	<b>10.74</b>
GF-1	31.82	36.36	189.12	94.06	24.32	120.27	<b>48.32</b>

**Table 12.** Red River Coal Company Monitoring Station VASCI Scoring Fall 2010.

Station ID	Number of Taxa	Number of EPT Taxa	Percent EPT	Percent Chiron.	Percent Two Dom Taxa	HBI Score	VASCI Score
SFP-1	27.27	9.09	0	44.44	17.84	57.92	<b>19.57</b>
SFP-2	45.45	45.45	83.67	76.60	63.03	79.79	<b>49.25</b>
SC-1	45.45	45.45	97.60	49.15	47.76	84.12	<b>46.19</b>
RC-1	63.64	54.55	26.13	53.49	47.05	66.69	<b>40.13</b>
GF-1	68.18	72.73	192.77	94.12	80.75	105.54	<b>64.47</b>

### 3.3 Habitat Assessment

Table 13 presents a summary of the habitat assessment scores for the Red River Coal Company monitoring stations from the March sampling event. Habitat assessment scores ranged from 138 (SC-1) (sub-optimal) to 162 (RC-1) (optimal).

Tables 14, 15 and 16 include a summary of habitat assessment scores from Fall and Spring 2011 and Fall 2010 sampling seasons.

**Table 13.** Red River Coal Company Monitoring Station RBP Habitat Scoring Spring 2012.

Parameter	SFP-1	SFP-2	SC-1	RC-1	GF-1
Subst./Cover	17	17	18	19	18
Embeddedness	16	16	14	16	14
Velocity	15	10	11	17	15
Sediment Dep.	13	17	16	16	12
Channel Flow	19	19	18	19	19
Channel Alt.	17	15	12	15	15
Freq of Riffles	16	20	19	18	19
Bank Stab L	8	10	7	9	8
Bank Stab R	8	9	5	7	8
Veg. Prot. L	6	10	5	9	9
Veg. Prot. R	9	4	8	6	9
Rip. Zone L	5	4	1	10	10
Rip. Zone R	10	0	4	1	2
<b>Total</b>	<b>159</b>	<b>151</b>	<b>138</b>	<b>162</b>	<b>158</b>

**Table 14.** Red River Coal Company Monitoring Station RBP Habitat Scoring Fall 2011.

Parameter	SFP-1	SFP-2	SC-1	RC-1	GF-1
Subst./Cover	14	17	18	19	16
Embeddedness	15	10	16	18	9
Velocity	4	19	15	15	15
Sediment Dep.	18	13	15	16	10
Channel Flow	16	17	13	15	17
Channel Alt.	19	12	18	10	18
Freq of Riffles	16	18	16	17	20
Bank Stab L	9	8	8	9	7
Bank Stab R	8	9	8	8	4
Veg. Prot. L	9	9	9	7	9
Veg. Prot. R	10	6	4	9	4
Rip. Zone L	8	4	10	2	10
Rip. Zone R	10	4	2	2	2
<b>Total</b>	<b>156</b>	<b>146</b>	<b>152</b>	<b>147</b>	<b>141</b>

**Table 15.** Red River Coal Company Monitoring Station RBP Habitat Scoring Spring 2011.

Parameter	SFP-1	SFP-2	SC-1	RC-1	GF-1
Subst./Cover	16	16	16	17	18
Embeddedness	18	17	12	13	16
Velocity	7	10	5	8	16
Sediment Dep.	19	19	19	19	18
Channel Flow	14	19	19	19	19
Channel Alt.	14	15	14	14	15
Freq of Riffles	17	19	19	19	11
Bank Stab L	6	8	9	9	9
Bank Stab R	9	9	9	9	9
Veg. Prot. L	5	9	6	10	10
Veg. Prot. R	10	9	6	7	9
Rip. Zone L	6	6	1	10	8
Rip. Zone R	10	3	1	0	7
<b>Total</b>	<b>151</b>	<b>159</b>	<b>136</b>	<b>154</b>	<b>165</b>



**Table 16.** Red River Coal Company Monitoring Station RBP Habitat Scoring Fall 2010.

Parameter	SFP-1	SFP-2	SC-1	RC-1	GF-1
Subst./Cover	17	14	10	8	11
Embeddedness	7	12	16	11	15
Velocity	11	19	8	4	11
Sediment Dep.	10	16	16	10	18
Channel Flow	13	16	9	9	14
Channel Alt.	11	12	10	11	15
Freq of Riffles	11	11	15	16	18
Bank Stab L	2	7	7	6	8
Bank Stab R	4	6	6	6	8
Veg. Prot. L	6	4	7	3	5
Veg. Prot. R	3	1	4	6	4
Rip. Zone L	2	3	4	1	7
Rip. Zone R	4	0	0	4	2
Total	101	121	112	95	136

### 3.4 Water Quality Assessment

Instream conductivity, pH, temperature and flow were recorded at each station. Table 17 presents the instream water quality assessments from the March 2012 sampling event. The conductivity ranged from 263 (SC-1) to 2070 (SFP-1) and the pH ranged from 7.05 (GF-1) to 8.10 (SFP-2). The water temperature ranged from 12.7 (GF-1) to 16.2 (RC-1) and flow ranged from 7.5 (GF-1) to 28.18 (SFP-2).

Tables 18, 19 and 20 include a summary of water quality analyses from Fall and Spring 2011 and Fall 2010 sampling seasons.

**Table 17.** Red River Coal Company Water Quality Analyses Spring 2012

Station ID	Conductivity( $\mu$ S/cm)	pH	Water Temp ( $^{\circ}$ C)	Flow (cfs)
SFP-1	2070	7.30	15.4	19.07
SFP-2	1887	8.10	15.4	28.18
SC-1	263	7.18	14.3	1.25
RC-1	1278	7.40	16.2	3.55
GF-1	523	7.05	12.7	7.5

**Table 18.** Red River Coal Company Water Quality Analyses Fall 2011

Station ID	Conductivity( $\mu$ S/cm)	pH	Water Temp ( $^{\circ}$ C)
SFP-1	2019	7.27	14.0
SFP-2	1899	8.23	12.6
SC-1	1192	7.7	10.0
RC-1	334	7.4	9.6
GF-1	494	7.35	8.1

**Table 19.** Red River Coal Company Water Quality Analyses Spring 2011

Station ID	Conductivity( $\mu$ S/cm)	Water Temp ( $^{\circ}$ C)
SFP-1	1857	12.9
SFP-2	1573	12.6
SC-1	267	11.9
RC-1	1175	11.9
GF-1	971	12.7

**Table 20.** Red River Coal Company Water Quality Analyses Fall 2010

Station ID	pH	Conductivity( $\mu$ S/cm)	Water Temp ( $^{\circ}$ C)	Dissolved Oxygen. (mg/L)
SFP-1	6.80	1899	14.3	5.40
SFP-2	8.37	2238	12.6	8.30
SC-1	6.87	1303	11.2	8.50
RC-1	6.72	338	11.1	7.00
GF-1	7.86	971	10	9.40

## **4.0 DISCUSSION**

Water quality and both instream and riparian habitat are important determinants of the composition, structure, and function of biotic communities. The instream water quality assessments and the RBP Habitat Assessment techniques used in this study do not provide adequate discriminatory power to differentiate cause and effect. A systematic assessment of instream and riparian habitat quality is necessary to fully assess water quality conditions in streams and rivers (USEPA 1999).

### **4.1 Station Location**

Since DMLR selected these sample locations, it is assumed that they are representative of the permit(s) in question. Furthermore, this study represents a significant component of the holistic watershed management approach cited in DMLR Guidance Memorandum 32-10 Revised (DMLR 2011).

### **4.2 Macroinvertebrate Data**

The VASCI values in this study should be considered a relative ranking, indicating the comparability of the studied stream to the statewide reference for least disturbed streams. As such, these values should not be considered an absolute rating.

The VASCI validation document recommends Aquatic Life Use tiers based on the VASCI scores (VADEQ 2006). These tiers and their respective scores are as follows:

- “Severe Stress indicates scores below 43;
- “Stress” indicates scores from 43 to 59;
- “Good” conditions indicate scores from 60 to 72; and
- “Excellent” stream quality is represented by scores above 72.

Table 21 presents a comparison of Fall 2010, Spring 2011, Fall 2011 and Spring 2012 VASCI scores. The VASCI scores from the Red River Coal Company sampling event of March 2012 fell within ALU tiers ranging from Severe Stress (13.76) for SFP-1 to Stress (54.87) for GF-1. The range of VASCI scores over all four sampling events were 10.74 at RC-1 (Spring 2011) to 64.47 at GF-1 (Fall 2010).

**Table 21.** Comparison of recent VASCI scores

Station ID	Fall 2010	Spring 2011	Fall 2011	Spring 2012
<b>SFP-1</b>	19.57	16.92	18.57	13.76
<b>SFP-2</b>	49.25	17.27	34.1	20.49
<b>SC-1</b>	46.19	15.81	50.02	33.52
<b>RC-1</b>	40.13	10.74	29.71	17.06
<b>GF-1</b>	64.47	48.32	53.29	54.87

At Station SFP-1, all four sampling events resulted in VASCI scores within the same ALU Tier (Severe Stress). At SFP-2, the Fall 2010 score represented the Stress tier while the other three season scores represented Severe Stress. Station SC-1 scored as Severe Stress in both the Spring seasons and Stress in the Fall seasons. At RC-1, all sampling events yielded the Severe Stress ALU. At Station GF-1, the Fall 2010 score fell within the Good ALU tier. The other three season scores were classified under the Stress ALU tier. Table 22 presents a comparison of the ALU tiers found in four seasons of sampling.

**Table 22.** Comparison of recent ALU tiers

Station ID	Fall 2010	Spring 2011	Fall 2011	Spring 2012
<b>SFP-1</b>	Severe Stress	Severe Stress	Severe Stress	Severe Stress
<b>SFP-2</b>	Stress	Severe Stress	Severe Stress	Severe Stress
<b>SC-1</b>	Stress	Severe Stress	Stress	Severe Stress
<b>RC-1</b>	Severe Stress	Severe Stress	Severe Stress	Severe Stress
<b>GF-1</b>	Good	Stress	Stress	Stress

### 4.3 Habitat Assessment

Habitat plays an important role in species composition, various assemblages and numbers of organisms found in aquatic environments. To make meaningful impact analyses, one must consider habitat data as a possible limiting factor. However, RBP habitat assessment techniques are qualitative in nature and designed to determine comparability and ranking amongst stations. Traditionally, this approach assumes the presence of a reference station for the data set. To further explore the role habitat may be playing on the benthic scores, additional data will have to be collected.

Table 23 presents a comparison of Fall 2010, Spring 2011, Fall 2011 and Spring 2012 Habitat Assessment scores. The habitat scores from the Red River Coal Company sampling event of March 2012 ranged from Sub-optimal (138) for SC-1 to Optimal (162) for RC-1. The range of Habitat Assessment scores over all four sampling events was 95 at RC-1 (Fall 2010) to 165 at GF-1 (Spring 2011).

**Table 23.** Comparison of recent Habitat Scores

Station ID	Fall 2010	Spring 2011	Fall 2011	Spring 2012
SFP-1	101	151	156	159
SFP-2	121	159	146	151
SC-1	112	136	152	138
RC-1	95	154	147	162
GF-1	136	165	141	158

At Station SFP-1, Fall 2010 and Spring 2011 sampling events resulted in Sub-optimal Habitat Assessment scores. The Fall 2011 and Spring 2012 sampling events for SFP-1 had Optimal Habitat Assessment scores. At SFP-2, the Spring 2011 score represented an Optimal Habitat Assessment score while the other three season scores represented Sub-optimal habitat. Station SC-1 scored as Sub-optimal in all four seasons. At RC-1, Fall 2010 had a Marginal habitat score while Fall 2011 was scored Sub-optimal. The other two seasons were said to have Optimal habitat. At Station GF-1, both Fall seasons scored within the Sub-optimal habitat category. The other two season scores were classified as

Optimal habitat. Table 24 presents a comparison of the Habitat Assessment scores found in four seasons of sampling.

**Table 24.** Comparison of recent Habitat Score Classifications

<b>Station ID</b>	<b>Fall 2010</b>	<b>Spring 2011</b>	<b>Fall 2011</b>	<b>Spring 2012</b>
<b>SFP-1</b>	Sub-optimal	Sub-optimal	Optimal	Optimal
<b>SFP-2</b>	Sub-optimal	Optimal	Sub-optimal	Sub-optimal
<b>SC-1</b>	Sub-optimal	Sub-optimal	Sub-optimal	Sub-optimal
<b>RC-1</b>	Marginal	Optimal	Sub-optimal	Optimal
<b>GF-1</b>	Sub-optimal	Optimal	Sub-optimal	Optimal

## **4.4 Water Quality Assessment**

The instream water chemistry parameters examined, conductivity, pH, temperature and flow, were typical for streams influenced by urban environments and mining in the region.



## 5.0 LITERATURE CITED

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## **APPENDIX A:**

# **STATION PHOTOGRAPHS AND DESCRIPTIONS**

## SFP-1



**Figure 2. Photos of SFP-1**

This station is the most upstream station on the South Fork Pound River. Upstream (top left), downstream (top right), left bank (bottom left) and right bank (bottom right) view of station SFP-1.



## SFP-2



**Figure 3.** *Photos of SFP-2*

Station SFP-2 is located on the South Fork Pound River downstream from the confluence of Rat Creek and South Fork Pound River. Upstream (top left), downstream (top right), left bank (bottom left) and right bank (bottom right) view of station SFP-2.



## SC-1



**Figure 4. Photos of SC-1**

Station SC-1 is located at the mouth of Short Creek. Upstream (top left), downstream (top right), left bank (bottom left) and right bank (bottom right) view of station SC-1.



## RC-1



**Figure 5. Photos of RC-1**

Station RC-1 is located upstream from the confluence of Rat Creek and Short Creek. Upstream (top left), downstream (top right), left bank (bottom left) and right bank (bottom right) view of station RC-1.



**GF-1**



**Figure 6. Photos of GF-1**

Station GF-1 is located near the mouth of Glady Fork. Upstream (top left), downstream (top right), left bank (bottom left) and right bank (bottom right) view of station GF-1.

## **APPENDIX B: MONITORING DATA**



**1800 KRAFT DRIVE SUITE 104 BLACKSBURG VIRGINIA 24060**

PH: 540-953-2821 FAX: 540-951-1481 WWW.BIOMON.COM

## Biological Sample Chain of Custody Form

Project Information	
Client: <i>Red River</i>	
Project Name:	
Project Number:	Station ID:
County/City:	State: <i>VA</i>
Stream Name:	Sample Season: <i>Spring 2012</i>

Sample Information							
Sample ID	Collection			Sample Type	Preservative	Collector Initial	QAO
	Date	Time	Method				
SFP-1	28 Mar 12	12:55	KN	Benthic	ETOH	HV	
SFP-2	28 Mar 12	10:56	KN	Benthic	ETOH	HV	
RC-1	28 Mar 12	12:04	KN	Benthic	ETOH	HV	
SC-1	28 Mar 12	11:46	KN	Benthic	ETOH	HV	
GF-1	28 Mar 12	09:40	KN	Benthic	ETOH	HV	

Comments	

[illegible]

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME <u>South Fork of the Round</u>		LOCATION
STATION # <u>SCP-1</u>	RIVER MILE	STREAM CLASS
LAT	LONG	RIVER BASIN
STORET #	AGENCY	
INVESTIGATORS <u>JOT HU SR</u>		
FORM COMPLETED BY	DATE <u>28 Mar 12</u> TIME <u>1255</u> AM <input checked="" type="radio"/> PM	REASON FOR SURVEY

WEATHER CONDITIONS	<table style="width: 100%;"> <tr> <td style="width: 33%;"> <b>Now</b>  <input type="checkbox"/> storm (heavy rain)  <input type="checkbox"/> rain (steady rain)  <input type="checkbox"/> showers (intermittent)  <input type="checkbox"/> %cloud cover  <input checked="" type="checkbox"/> clear/sunny             </td> <td style="width: 33%;"> <b>Past 24 hours</b>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/> %  <input type="checkbox"/> </td> <td style="width: 33%;"> <b>Has there been a heavy rain in the last 7 days?</b>  <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Air Temperature</b> <u>65</u> °C  <b>Other</b> </td> </tr> </table>	<b>Now</b> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover <input checked="" type="checkbox"/> clear/sunny	<b>Past 24 hours</b> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % <input type="checkbox"/>	<b>Has there been a heavy rain in the last 7 days?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Air Temperature</b> <u>65</u> °C <b>Other</b>
<b>Now</b> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover <input checked="" type="checkbox"/> clear/sunny	<b>Past 24 hours</b> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % <input type="checkbox"/>	<b>Has there been a heavy rain in the last 7 days?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Air Temperature</b> <u>65</u> °C <b>Other</b>		
SITE LOCATION/MAP	<p>Draw a map of the site and indicate the areas sampled (or attach a photograph)</p> <p style="text-align: center; font-size: 1.2em;">LAT 37°03'95"</p> <p style="text-align: center; font-size: 1.2em;">LONG 82°41'64"</p> <p style="text-align: center; font-size: 1.2em;">Photos</p> <p style="text-align: center; font-size: 1.2em;">All Photos: Down, up, Left, Right, Substrate, Sky</p>			
STREAM CHARACTERIZATION	<table style="width: 100%;"> <tr> <td style="width: 50%;"> <b>Stream Subsystem</b>  <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal  <b>Stream Origin</b>  <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed  <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins  <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other             </td> <td style="width: 50%;"> <b>Stream Type</b>  <input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater  <b>Catchment Area</b> _____ km<sup>2</sup> </td> </tr> </table>	<b>Stream Subsystem</b> <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal <b>Stream Origin</b> <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other	<b>Stream Type</b> <input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater <b>Catchment Area</b> _____ km <sup>2</sup>	
<b>Stream Subsystem</b> <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal <b>Stream Origin</b> <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other	<b>Stream Type</b> <input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater <b>Catchment Area</b> _____ km <sup>2</sup>			

# **PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)**

<b>WATERSHED FEATURES</b>	Predominant Surrounding Landuse <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <u>road</u> <input type="checkbox"/> Residential		Local Watershed NPS Pollution <input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources  Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy
<b>RIPARIAN VEGETATION</b> (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input checked="" type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present _____		
<b>INSTREAM FEATURES</b>	Estimated Reach Length _____ m Estimated Stream Width <u>4.5</u> m Sampling Reach Area _____ m <sup>2</sup> Area in km <sup>2</sup> (m <sup>2</sup> x 1000) _____ km <sup>2</sup> Estimated Stream Depth _____ m Surface Velocity (at thalweg) _____ m/sec  Canopy Cover <input type="checkbox"/> Partly open <input checked="" type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark _____ m Proportion of Reach Represented by Stream Morphology Types <input checked="" type="checkbox"/> Riffle <u>30</u> % <input type="checkbox"/> Run <u>60</u> % <input checked="" type="checkbox"/> Pool <u>10</u> % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
<b>LARGE WOODY DEBRIS</b>	LWD _____ m <sup>2</sup> Density of LWD _____ m <sup>2</sup> /km <sup>2</sup> (LWD/ reach area)		
<b>AQUATIC VEGETATION</b>	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation _____ %		
<b>WATER QUALITY</b>	Temperature <u>15.4</u> °C Specific Conductance <u>7070</u> Dissolved Oxygen _____ pH <u>7.30</u> Turbidity _____ WQ Instrument Used _____  Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globes <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____		
<b>SEDIMENT/SUBSTRATE</b>	Odors <input type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input checked="" type="checkbox"/> Other <u>4.5</u>  Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Looking at stones which are not deeply embedded, are the undersides black in color? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		

left descending bank full of iron floc

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	<u>30</u>	Muck-Mud	black, very fine organic (FPOM)	
Cobble	64-256 mm (2.5"-10")	<u>15</u>			
Gravel	2-64 mm (0.1"-2.5")	<u>45</u>			
Sand	0.06-2mm (gritty)				
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <u>South Fork of the Peard</u>		LOCATION	
STATION # <u>SFP-2</u> RIVERMILE		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS <u>TP HV JR</u>			
FORM COMPLETED BY <u>HV</u>		DATE <u>28 May 12</u> TIME <u>1:00</u> AM <input checked="" type="radio"/>	REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE <u>17</u>				
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE <u>16</u>				
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE <u>15</u>				
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE <u>13</u>				
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE <u>19</u>				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE <u>17</u>				
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE <u>16</u>				
8. Bank Stability (score each bank)  Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE <u>8</u> (LB) SCORE <u>8</u> (RB)				
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE <u>6</u> (LB) SCORE <u>9</u> (RB)				
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE <u>5</u> (LB) SCORE <u>10</u> (RB)				

Total Score 159

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME <u>South Fork Bond</u>		LOCATION	
STATION # <u>SFP-2</u> RIVERMILE		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY <u>BMI</u>	
INVESTIGATORS			
FORM COMPLETED BY		DATE <u>25 MAR 12</u> TIME <u>1656</u> AM PM	REASON FOR SURVEY

<b>WEATHER CONDITIONS</b>	<table style="width: 100%;"> <tr> <td style="width: 50%;"> <b>Now</b>  <input type="checkbox"/> storm (heavy rain)  <input type="checkbox"/> rain (steady rain)  <input type="checkbox"/> showers (intermittent)  <input type="checkbox"/> %cloud cover  <input checked="" type="checkbox"/> clear/sunny                 </td> <td style="width: 50%;"> <b>Past 24 hours</b>  <input type="checkbox"/>  <input checked="" type="checkbox"/> %  <input type="checkbox"/> </td> </tr> <tr> <td colspan="2"> <b>Has there been a heavy rain in the last 7 days?</b>  <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Air Temperature</b> <u>65</u> °C  <b>Other</b> _____                 </td> </tr> </table>	<b>Now</b> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover <input checked="" type="checkbox"/> clear/sunny	<b>Past 24 hours</b> <input type="checkbox"/> <input checked="" type="checkbox"/> % <input type="checkbox"/>	<b>Has there been a heavy rain in the last 7 days?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Air Temperature</b> <u>65</u> °C <b>Other</b> _____	
<b>Now</b> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover <input checked="" type="checkbox"/> clear/sunny	<b>Past 24 hours</b> <input type="checkbox"/> <input checked="" type="checkbox"/> % <input type="checkbox"/>				
<b>Has there been a heavy rain in the last 7 days?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Air Temperature</b> <u>65</u> °C <b>Other</b> _____					
<b>SITE LOCATION/MAP</b>	Draw a map of the site and indicate the areas sampled (or attach a photograph)  <div style="text-align: center; font-size: 2em; margin-top: 50px;">                     Photos                       361-366                 </div>				
<b>STREAM CHARACTERIZATION</b>	<table style="width: 100%;"> <tr> <td style="width: 50%;"> <b>Stream Subsystem</b>  <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal   <b>Stream Origin</b>  <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed  <input type="checkbox"/> Non-glacial montane <input checked="" type="checkbox"/> Mixture of origins  <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____                 </td> <td style="width: 50%;"> <b>Stream Type</b>  <input checked="" type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater   <b>Catchment Area</b> _____ km<sup>2</sup> </td> </tr> </table>	<b>Stream Subsystem</b> <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal  <b>Stream Origin</b> <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input checked="" type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	<b>Stream Type</b> <input checked="" type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater  <b>Catchment Area</b> _____ km <sup>2</sup>		
<b>Stream Subsystem</b> <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal  <b>Stream Origin</b> <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input checked="" type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	<b>Stream Type</b> <input checked="" type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater  <b>Catchment Area</b> _____ km <sup>2</sup>				



# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

<b>WATERSHED FEATURES</b>	Predominant Surrounding Landuse <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input checked="" type="checkbox"/> Agricultural <input type="checkbox"/> Other _____ <input type="checkbox"/> Residential		Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input checked="" type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources  Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy
<b>RIPARIAN VEGETATION</b> (18 meter buffer)	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present _____		
<b>INSTREAM FEATURES</b>	Estimated Reach Length _____ m Estimated Stream Width _____ m Sampling Reach Area _____ m <sup>2</sup> Area in km <sup>2</sup> (m <sup>2</sup> x 1000) _____ km <sup>2</sup> Estimated Stream Depth _____ m Surface Velocity (at thalweg) _____ m/sec  Canopy Cover <input type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark _____ m Proportion of Reach Represented by Stream Morphology Types <input type="checkbox"/> Riffle _____ % <input type="checkbox"/> Run _____ % <input type="checkbox"/> Pool _____ % Channelized <input type="checkbox"/> Yes <input type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input type="checkbox"/> No		
<b>LARGE WOODY DEBRIS</b>	LWD _____ m <sup>2</sup> Density of LWD _____ m <sup>2</sup> /km <sup>2</sup> (LWD/ reach area)		
<b>AQUATIC VEGETATION</b>	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input type="checkbox"/> Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation <u>20</u> %		
<b>WATER QUALITY</b>	Temperature <u>15.4</u> °C Specific Conductance <u>1887</u> Dissolved Oxygen <u>N/A</u> pH <u>8.10</u> Turbidity _____ WQ Instrument Used _____  Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globes <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____		
<b>SEDIMENT/SUBSTRATE</b>	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Looking at stones which are not deeply embedded, are the undersides black in color? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	<u>15%</u>	Muck-Mud	black, very fine organic (FPOM)	
Cobble	64-256 mm (2.5"-10")	<u>40%</u>	Marl	gray, shell fragments	
Gravel	2-64 mm (0.1"-2.5")	<u>30%</u>			
Sand	0.06-2mm (gritty)	<u>10%</u>			
Silt	0.004-0.06 mm	<u>5%</u>			
Clay	< 0.004 mm (slick)				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <u>South Fork Pound</u>		LOCATION	
STATION # <u>SFP-2</u> RIVERMILE		STREAM CLASS	
LAT LONG		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS			
FORM COMPLETED BY		DATE TIME AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or locking.
	SCORE 17				
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE 16				
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
	SCORE 10				
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 17				
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 19				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
<b>6. Channel Alteration</b>  <b>SCORE 15</b>	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>7. Frequency of Riffles (or bends)</b>  <b>SCORE 20</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
<b>8. Bank Stability (score each bank)</b>  Note: determine left or right side by facing downstream. <b>SCORE 10 (LB)</b> <b>SCORE 9 (RB)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>9. Vegetative Protection (score each bank)</b>  <b>SCORE 10 (LB)</b> <b>SCORE 4 (RB)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody rhacrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>10. Riparian Vegetative Zone Width (score each bank riparian zone)</b>  <b>SCORE 4 (LB)</b> <b>SCORE 0 (RB)</b>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.

Total Score 151

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME <u>Short Creek</u>		LOCATION
STATION # <u>SC-1</u>	RIVER MILE	STREAM CLASS
LAT	LONG	RIVER BASIN
STORET #		AGENCY
INVESTIGATORS		
FORM COMPLETED BY	DATE <u>28 March 2017</u> TIME <u>1146</u> <u>AM</u> PM	REASON FOR SURVEY

<b>WEATHER CONDITIONS</b>	<table style="width: 100%;"> <tr> <td style="width: 50%;"> <b>Now</b>  <input type="checkbox"/> storm (heavy rain)  <input type="checkbox"/> rain (steady rain)  <input type="checkbox"/> showers (intermittent)  <input type="checkbox"/> % cloud cover  <input checked="" type="checkbox"/> clear/sunny                 </td> <td style="width: 50%;"> <b>Past 24 hours</b>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/> %  <input type="checkbox"/> </td> </tr> </table>	<b>Now</b> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> % cloud cover <input checked="" type="checkbox"/> clear/sunny	<b>Past 24 hours</b> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % <input type="checkbox"/>
<b>Now</b> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> % cloud cover <input checked="" type="checkbox"/> clear/sunny	<b>Past 24 hours</b> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % <input type="checkbox"/>		
<b>SITE LOCATION/MAP</b>	Draw a map of the site and indicate the areas sampled (or attach a photograph)  <div style="text-align: center; font-size: 2em; transform: rotate(-15deg); opacity: 0.5;">Photos 367-372</div>		
<b>STREAM CHARACTERIZATION</b>	<table style="width: 100%;"> <tr> <td style="width: 50%;"> <b>Stream Subsystem</b>  <input type="checkbox"/> Perennial   <input type="checkbox"/> Intermittent   <input type="checkbox"/> Tidal   <b>Stream Origin</b>  <input type="checkbox"/> Glacial   <input type="checkbox"/> Spring-fed  <input type="checkbox"/> Non-glacial montane   <input type="checkbox"/> Mixture of origins  <input type="checkbox"/> Swamp and bog   <input type="checkbox"/> Other                 </td> <td style="width: 50%;"> <b>Stream Type</b>  <input type="checkbox"/> Coldwater   <input type="checkbox"/> Warmwater   <b>Catchment Area</b> _____ km<sup>2</sup> </td> </tr> </table>	<b>Stream Subsystem</b> <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal  <b>Stream Origin</b> <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other	<b>Stream Type</b> <input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater  <b>Catchment Area</b> _____ km <sup>2</sup>
<b>Stream Subsystem</b> <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal  <b>Stream Origin</b> <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other	<b>Stream Type</b> <input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater  <b>Catchment Area</b> _____ km <sup>2</sup>		

# **PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)**

<b>WATERSHED FEATURES</b>	Predominant Surrounding Landuse <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <u>Road</u> <input checked="" type="checkbox"/> Residential		Local Watershed NPS Pollution <input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources  Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy
<b>RIPARIAN VEGETATION</b> (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present _____		
<b>INSTREAM FEATURES</b>	Estimated Reach Length _____ m Estimated Stream Width <u>2</u> m Sampling Reach Area _____ m <sup>2</sup> Area in km <sup>2</sup> (m <sup>2</sup> x 1000) _____ km <sup>2</sup> Estimated Stream Depth _____ m Surface Velocity _____ m/sec Canopy Cover <input type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input checked="" type="checkbox"/> Shaded High Water Mark _____ m Proportion of Reach Represented by Stream Morphology Types <input checked="" type="checkbox"/> Riffle <u>85</u> % <input type="checkbox"/> Run _____ % <input checked="" type="checkbox"/> Pool <u>15</u> % Channelized <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
<b>LARGE WOODY DEBRIS</b>	LWD _____ m <sup>2</sup> Density of LWD _____ m <sup>2</sup> /km <sup>2</sup> (LWD/ reach area)		
<b>AQUATIC VEGETATION</b>	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input checked="" type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation _____ %		
<b>WATER QUALITY</b>	Temperature <u>14.3</u> °C Specific Conductance <u>263</u> Dissolved Oxygen _____ pH <u>7.18</u> Turbidity _____ WQ Instrument Used _____ Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____		
<b>SEDIMENT/SUBSTRATE</b>	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anoxic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Looking at stones which are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input type="checkbox"/> No		

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	<u>30</u>	Muck-Mud	black, very fine organic (FPOM)	
Cobble	64-256 mm (2.5"-10")	<u>60</u>			
Gravel	2-64 mm (0.1"-2.5")	<u>10</u>	Marl	grey, shell fragments	
Sand	0.06-2mm (gritty)				
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

# HABITAT ASSESSMENT FIELD DATA SHEET--HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <u>Shore Creek</u>	LOCATION	
STATION # <u>SC-1</u> RIVERMILE	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS <u>DPJ HV JR</u>		
FORM COMPLETED BY <u>HV</u>	DATE <u>26 March 2012</u> TIME <u>11:50</u> <u>AM</u> PM	REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE <u>18</u>				
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE <u>14</u>				
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE <u>11</u>				
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE <u>16</u>				
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE <u>18</u>				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
<b>6. Channel Alteration</b>  SCORE <u>12</u>	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>7. Frequency of Riffles (or bends)</b>  SCORE <u>19</u>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
<b>8. Bank Stability (score each bank)</b>  Note: determine left or right side by facing downstream. SCORE <u>7</u> (LB) SCORE <u>5</u> (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>9. Vegetative Protection (score each bank)</b>  SCORE <u>5</u> (LB) SCORE <u>8</u> (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>10. Riparian Vegetative Zone Width (score each bank riparian zone)</b>  SCORE <u>1</u> (LB) SCORE <u>4</u> (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.

Total Score 138

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME <u>Rat Creek</u>		LOCATION	
STATION # <u>RC-1</u> RIVERMILE		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS <u>TPT HV JRR</u>			
FORM COMPLETED BY		DATE <u>28 Mar 2012</u> TIME <u>7:04</u> AM <input checked="" type="radio"/> PM	REASON FOR SURVEY

WEATHER CONDITIONS	<table style="width: 100%;"> <tr> <td style="width: 50%;"> <b>Now</b>  <input type="checkbox"/> storm (heavy rain)  <input type="checkbox"/> rain (steady rain)  <input type="checkbox"/> showers (intermittent)  <input type="checkbox"/> %cloud cover _____  <input checked="" type="checkbox"/> clear/sunny                 </td> <td style="width: 50%;"> <b>Past 24 hours</b>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/> % _____  <input type="checkbox"/> </td> </tr> <tr> <td colspan="2"> <b>Has there been a heavy rain in the last 7 days?</b>  <input type="checkbox"/> Yes <input type="checkbox"/> No  <b>Air Temperature</b> <u>65</u> °C  <b>Other</b> _____                 </td> </tr> </table>	<b>Now</b> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover _____ <input checked="" type="checkbox"/> clear/sunny	<b>Past 24 hours</b> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % _____ <input type="checkbox"/>	<b>Has there been a heavy rain in the last 7 days?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Air Temperature</b> <u>65</u> °C <b>Other</b> _____	
<b>Now</b> <input type="checkbox"/> storm (heavy rain) <input type="checkbox"/> rain (steady rain) <input type="checkbox"/> showers (intermittent) <input type="checkbox"/> %cloud cover _____ <input checked="" type="checkbox"/> clear/sunny	<b>Past 24 hours</b> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> % _____ <input type="checkbox"/>				
<b>Has there been a heavy rain in the last 7 days?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Air Temperature</b> <u>65</u> °C <b>Other</b> _____					
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)  <div style="text-align: center; font-size: 1.2em; margin-top: 50px;">Photos 373-378</div>				
STREAM CHARACTERIZATION	<table style="width: 100%;"> <tr> <td style="width: 50%;"> <b>Stream Subsystem</b>  <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal   <b>Stream Origin</b>  <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed  <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins  <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____                 </td> <td style="width: 50%;"> <b>Stream Type</b>  <input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater   <b>Catchment Area</b> _____ km<sup>2</sup> </td> </tr> </table>	<b>Stream Subsystem</b> <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal  <b>Stream Origin</b> <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	<b>Stream Type</b> <input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater  <b>Catchment Area</b> _____ km <sup>2</sup>		
<b>Stream Subsystem</b> <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal  <b>Stream Origin</b> <input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed <input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____	<b>Stream Type</b> <input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater  <b>Catchment Area</b> _____ km <sup>2</sup>				



# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

<b>WATERSHED FEATURES</b>	<b>Predominant Surrounding Landuse</b> <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Other <u>road</u> <input type="checkbox"/> Residential		<b>Local Watershed NPS Pollution</b> <input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources  <b>Local Watershed Erosion</b> <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy	
<b>RIPARIAN VEGETATION</b> (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present _____			
<b>INSTREAM FEATURES</b>	<table style="width: 100%;"> <tr> <td style="width: 50%;">           Estimated Reach Length _____ m            Estimated Stream Width <u>3</u> m            Sampling Reach Area _____ m<sup>2</sup>            Area in km<sup>2</sup> (m<sup>2</sup> x 1000) _____ km<sup>2</sup>            Estimated Stream Depth _____ m            Surface Velocity _____ m/sec (at thalweg)         </td> <td style="width: 50%;">           Canopy Cover  <input checked="" type="checkbox"/> Partly open    <input type="checkbox"/> Partly shaded    <input type="checkbox"/> Shaded             High Water Mark _____ m             Proportion of Reach Represented by Stream Morphology Types  <input checked="" type="checkbox"/> Riffle <u>30</u> %    <input checked="" type="checkbox"/> Run <u>30</u> %  <input type="checkbox"/> Pool <u>40</u> %             Channelized    <input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No            Dam Present    <input type="checkbox"/> Yes    <input checked="" type="checkbox"/> No         </td> </tr> </table>		Estimated Reach Length _____ m Estimated Stream Width <u>3</u> m Sampling Reach Area _____ m <sup>2</sup> Area in km <sup>2</sup> (m <sup>2</sup> x 1000) _____ km <sup>2</sup> Estimated Stream Depth _____ m Surface Velocity _____ m/sec (at thalweg)	Canopy Cover <input checked="" type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded  High Water Mark _____ m  Proportion of Reach Represented by Stream Morphology Types <input checked="" type="checkbox"/> Riffle <u>30</u> % <input checked="" type="checkbox"/> Run <u>30</u> % <input type="checkbox"/> Pool <u>40</u> %  Channelized <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Estimated Reach Length _____ m Estimated Stream Width <u>3</u> m Sampling Reach Area _____ m <sup>2</sup> Area in km <sup>2</sup> (m <sup>2</sup> x 1000) _____ km <sup>2</sup> Estimated Stream Depth _____ m Surface Velocity _____ m/sec (at thalweg)	Canopy Cover <input checked="" type="checkbox"/> Partly open <input type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded  High Water Mark _____ m  Proportion of Reach Represented by Stream Morphology Types <input checked="" type="checkbox"/> Riffle <u>30</u> % <input checked="" type="checkbox"/> Run <u>30</u> % <input type="checkbox"/> Pool <u>40</u> %  Channelized <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
<b>LARGE WOODY DEBRIS</b>	LWD _____ m <sup>2</sup> Density of LWD _____ m <sup>2</sup> /km <sup>2</sup> (LWD/ reach area)			
<b>AQUATIC VEGETATION</b>	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free-floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation _____ %			
<b>WATER QUALITY</b>	<table style="width: 100%;"> <tr> <td style="width: 50%;">           Temperature <u>16.2</u> °C            Specific Conductance <u>1278</u>            Dissolved Oxygen _____            pH <u>7.40</u>            Turbidity _____            WQ Instrument Used _____         </td> <td style="width: 50%;">           Water Odors  <input checked="" type="checkbox"/> Normal/None    <input type="checkbox"/> Sewage  <input type="checkbox"/> Petroleum    <input type="checkbox"/> Chemical  <input type="checkbox"/> Fishy    <input type="checkbox"/> Other _____             Water Surface Oils  <input type="checkbox"/> Slick    <input type="checkbox"/> Sheen    <input type="checkbox"/> Globes    <input type="checkbox"/> Flecks  <input checked="" type="checkbox"/> None    <input type="checkbox"/> Other _____             Turbidity (if not measured)  <input checked="" type="checkbox"/> Clear    <input type="checkbox"/> Slightly turbid    <input type="checkbox"/> Turbid  <input type="checkbox"/> Opaque    <input type="checkbox"/> Stained    <input type="checkbox"/> Other _____         </td> </tr> </table>		Temperature <u>16.2</u> °C Specific Conductance <u>1278</u> Dissolved Oxygen _____ pH <u>7.40</u> Turbidity _____ WQ Instrument Used _____	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____  Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globes <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____  Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____
Temperature <u>16.2</u> °C Specific Conductance <u>1278</u> Dissolved Oxygen _____ pH <u>7.40</u> Turbidity _____ WQ Instrument Used _____	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____  Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globes <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____  Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____			
<b>SEDIMENT/SUBSTRATE</b>	<table style="width: 100%;"> <tr> <td style="width: 50%;"> <b>Odors</b>  <input checked="" type="checkbox"/> Normal    <input type="checkbox"/> Sewage    <input type="checkbox"/> Petroleum  <input type="checkbox"/> Chemical    <input type="checkbox"/> Anaerobic    <input type="checkbox"/> None  <input type="checkbox"/> Other _____   <b>Oils</b>  <input checked="" type="checkbox"/> Absent    <input type="checkbox"/> Slight    <input type="checkbox"/> Moderate    <input type="checkbox"/> Profuse         </td> <td style="width: 50%;"> <b>Deposits</b>  <input type="checkbox"/> Sludge    <input type="checkbox"/> Sawdust    <input type="checkbox"/> Paper fiber    <input type="checkbox"/> Sand  <input type="checkbox"/> Relict shells    <input type="checkbox"/> Other _____             Looking at stones which are not deeply embedded,            are the undersides black in color?  <input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No         </td> </tr> </table>		<b>Odors</b> <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____  <b>Oils</b> <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	<b>Deposits</b> <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____  Looking at stones which are not deeply embedded, are the undersides black in color? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Odors</b> <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____  <b>Oils</b> <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	<b>Deposits</b> <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____  Looking at stones which are not deeply embedded, are the undersides black in color? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	<u>70</u> %	Muck-Mud	black, very fine organic (FPOM)	
Cobble	64-256 mm (2.5"-10")	<u>20</u> %	Marl	grey, shell fragments	
Gravel	2-64 mm (0.1"-2.5")	<u>10</u> %			
Sand	0.06-2mm (gritty)				
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <u>Rat Creek</u>		LOCATION	
STATION # <u>RC-1</u> RIVERMILE		STREAM CLASS	
LAT LONG		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS <u>TPI HV JR</u>			
FORM COMPLETED BY		DATE <u>28 Mar 2012</u> TIME <u>1248</u> AM <input checked="" type="radio"/> PM	REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE <u>19</u>				
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE <u>16</u>				
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE <u>17</u>				
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE <u>16</u>				
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE <u>19</u>				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
<b>6. Channel Alteration</b>  SCORE <u>15</u>	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>7. Frequency of Riffles (or bends)</b>  SCORE <u>18</u>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
<b>8. Bank Stability (score each bank)</b>  Note: determine left or right side by facing downstream. SCORE <u>9</u> (LB) SCORE <u>7</u> (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>9. Vegetative Protection (score each bank)</b>  SCORE <u>9</u> (LB) SCORE <u>6</u> (RB)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>10. Riparian Vegetative Zone Width (score each bank riparian zone)</b>  SCORE <u>10</u> (LB) SCORE <u>1</u> (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.

Total Score 162

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME <u>Gladys Fork</u>	LOCATION	
STATION # <u>GF-1</u> RIVERMILE	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS <u>TPV HV JR</u>		
FORM COMPLETED BY <u>HV</u>	DATE <u>28 Mar 2012</u> TIME <u>940</u> <u>AM</u> PM	REASON FOR SURVEY

<b>WEATHER CONDITIONS</b>	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>Now</b></p> <p><input type="checkbox"/> storm (heavy rain)</p> <p><input type="checkbox"/> rain (steady rain)</p> <p><input type="checkbox"/> showers (intermittent)</p> <p><input type="checkbox"/> %cloud cover _____</p> <p><input checked="" type="checkbox"/> clear/sunny</p> </div> <div style="width: 45%;"> <p><b>Past 24 hours</b></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/> % _____</p> </div> </div> <div style="margin-top: 10px;"> <p><b>Has there been a heavy rain in the last 7 days?</b></p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p><b>Air Temperature</b> <u>58</u> °C</p> <p><b>Other</b> _____</p> </div>
<b>SITE LOCATION/MAP</b>	<p>Draw a map of the site and indicate the areas sampled (or attach a photograph)</p> <div style="height: 300px; border: 1px solid black; position: relative; margin-top: 20px;"> <div style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); font-size: 2em;">           Photos 355-360         </div> </div>
<b>STREAM CHARACTERIZATION</b>	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>Stream Subsystem</b></p> <p><input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Tidal</p> <p><b>Stream Origin</b></p> <p><input type="checkbox"/> Glacial <input type="checkbox"/> Spring-fed</p> <p><input type="checkbox"/> Non-glacial montane <input type="checkbox"/> Mixture of origins</p> <p><input type="checkbox"/> Swamp and bog <input type="checkbox"/> Other _____</p> </div> <div style="width: 45%;"> <p><b>Stream Type</b></p> <p><input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater</p> <p><b>Catchment Area</b> _____ km<sup>2</sup></p> </div> </div>

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

<b>WATERSHED FEATURES</b>	Predominant Surrounding Landuse <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input type="checkbox"/> Other _____ <input checked="" type="checkbox"/> Residential		Local Watershed NPS Pollution <input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious sources  Local Watershed Erosion <input checked="" type="checkbox"/> None <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy
<b>RIPARIAN VEGETATION</b> (18 meter buffer)	Indicate the dominant type and record the dominant species present <input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous dominant species present <u>Hemlock</u>		
<b>INSTREAM FEATURES</b>	Estimated Reach Length _____ m Estimated Stream Width <u>4</u> m Sampling Reach Area _____ m <sup>2</sup> Area in km <sup>2</sup> (m <sup>2</sup> x 1000) _____ km <sup>2</sup> Estimated Stream Depth _____ m Surface Velocity (at thalweg) _____ m/sec  Canopy Cover <input type="checkbox"/> Partly open <input checked="" type="checkbox"/> Partly shaded <input type="checkbox"/> Shaded High Water Mark _____ m Proportion of Reach Represented by Stream Morphology Types <input checked="" type="checkbox"/> Riffle <u>100</u> % <input checked="" type="checkbox"/> Run <u>40</u> % <input type="checkbox"/> Pool _____ % Channelized <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Dam Present <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
<b>LARGE WOODY DEBRIS</b>	LWD _____ m <sup>2</sup> Density of LWD _____ m <sup>2</sup> /km <sup>2</sup> (LWD/reach area)		
<b>AQUATIC VEGETATION</b>	Indicate the dominant type and record the dominant species present <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free floating <input type="checkbox"/> Floating Algae <input checked="" type="checkbox"/> Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation <u>80</u> %		
<b>WATER QUALITY</b>	Temperature <u>12.7</u> °C Specific Conductance <u>523</u> Dissolved Oxygen _____ pH <u>7.05</u> Turbidity _____ WQ Instrument Used _____  Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____ Water Surface Oils <input type="checkbox"/> Slick <input type="checkbox"/> Sheen <input type="checkbox"/> Globs <input type="checkbox"/> Flecks <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ Turbidity (if not measured) <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque <input type="checkbox"/> Stained <input type="checkbox"/> Other _____		
<b>SEDIMENT/SUBSTRATE</b>	Odors <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> None <input type="checkbox"/> Other _____ Deposits <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____ Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Looking at stones which are not deeply embedded, are the undersides black in color? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	<u>15</u>	Muck-Mud	black, very fine organic (FPOM)	
Cobble	64-256 mm (2.5"-10")	<u>75</u>	Marl	grey, shell fragments	
Gravel	2-64 mm (0.1"-2.5")	<u>10</u>			
Sand	0.06-2mm (gritty)				
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <u>Glady Fork</u>	LOCATION	
STATION # <u>0F-1</u> RIVERMILE	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS <u>JPT HV JR</u>		
FORM COMPLETED BY	DATE <u>28 Mar 2012</u> TIME <u>9:40</u> <u>AM</u> PM	REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 18				
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 14				
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE 15				
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12				
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 19				

# HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
<b>6. Channel Alteration</b>  <b>SCORE 15</b>	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
<b>7. Frequency of Riffles (or bends)</b>  <b>SCORE 19</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
<b>8. Bank Stability (score each bank)</b>  Note: determine left or right side by facing downstream. <b>SCORE 8 (LB)</b> <b>SCORE 8 (RB)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
<b>9. Vegetative Protection (score each bank)</b>  <b>SCORE 9 (LB)</b> <b>SCORE 9 (RB)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
<b>10. Riparian Vegetative Zone Width (score each bank riparian zone)</b>  <b>SCORE 10 (LB)</b> <b>SCORE 2 (RB)</b>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.

Total Score 158

## VASCI Benthic Macroinvertebrate Metric Spreadsheet

<b>Client</b>	Red River Coal Company
<b>Facility</b>	BM1
<b>Project Number</b>	3886

<b>Station ID</b>	SFP-1
<b>Stream Name</b>	South Fork Pound
<b>Sample Season</b>	Spring 2012

## Coleoptera

- Carabidae  
Chrysomelidae  
Curculionidae  
Dryopidae  
Dytiscidae  
Elmidae  
Gyrinidae  
Halipidae  
Hydraenidae  
Hydrophilidae  
Lampyridae  
Noteridae  
Psephenidae  
Ptilodactylidae  
Sciirtidae  
Staphylinidae

[illegible][illegible]

## Diptera

- Athericidae  
Blephariceridae  
Ceratopogonidae  
Chaoboridae  
Chironomidae  
Culicidae  
Dixidae  
Dolichopodidae  
Empididae  
Ephydriidae  
Muscidae  
Phoridae  
Psychodidae  
Sciomyzidae  
Simuliidae  
Stratiomyidae  
Syrphidae  
Tabanidae  
Tanyderidae  
Tipulidae

DATE	DESCRIPTION	AMOUNT	CHECK NO.	BANK	REMARKS
10/1/2017	DEPOSIT	100.00			
10/2/2017	DEPOSIT	100.00			
10/3/2017	DEPOSIT	100.00			
10/4/2017	DEPOSIT	100.00			
10/5/2017	DEPOSIT	100.00			
10/6/2017	DEPOSIT	100.00			
10/7/2017	DEPOSIT	100.00			
10/8/2017	DEPOSIT	100.00			
10/9/2017	DEPOSIT	100.00			
10/10/2017	DEPOSIT	100.00			
10/11/2017	DEPOSIT	100.00			
10/12/2017	DEPOSIT	100.00			
10/13/2017	DEPOSIT	100.00			
10/14/2017	DEPOSIT	100.00			
10/15/2017	DEPOSIT	100.00			
10/16/2017	DEPOSIT	100.00			
10/17/2017	DEPOSIT	100.00			
10/18/2017	DEPOSIT	100.00			
10/19/2017	DEPOSIT	100.00			
10/20/2017	DEPOSIT	100.00			
10/21/2017	DEPOSIT	100.00			
10/22/2017	DEPOSIT	100.00			
10/23/2017	DEPOSIT	100.00			
10/24/2017	DEPOSIT	100.00			
10/25/2017	DEPOSIT	100.00			
10/26/2017	DEPOSIT	100.00			
10/27/2017	DEPOSIT	100.00			
10/28/2017	DEPOSIT	100.00			
10/29/2017	DEPOSIT	100.00			
10/30/2017	DEPOSIT	100.00			
10/31/2017	DEPOSIT	100.00			
11/1/2017	DEPOSIT	100.00			
11/2/2017	DEPOSIT	100.00			
11/3/2017	DEPOSIT	100.00			
11/4/2017	DEPOSIT	100.00			
11/5/2017	DEPOSIT	100.00			
11/6/2017	DEPOSIT	100.00			
11/7/2017	DEPOSIT	100.00			
11/8/2017	DEPOSIT	100.00			
11/9/2017	DEPOSIT	100.00			
11/10/2017	DEPOSIT	100.00			
11/11/2017	DEPOSIT	100.00			
11/12/2017	DEPOSIT	100.00			
11/13/2017	DEPOSIT	100.00			
11/14/2017	DEPOSIT	100.00			
11/15/2017	DEPOSIT	100.00			
11/16/2017	DEPOSIT	100.00			
11/17/2017	DEPOSIT	100.00			
11/18/2017	DEPOSIT	100.00			
11/19/2017	DEPOSIT	100.00			
11/20/2017	DEPOSIT	100.00			
11/21/2017	DEPOSIT	100.00			
11/22/2017	DEPOSIT	100.00			
11/23/2017	DEPOSIT	100.00			
11/24/2017	DEPOSIT	100.00			
11/25/2017	DEPOSIT	100.00			
11/26/2017	DEPOSIT	100.00			
11/27/2017	DEPOSIT	100.00			
11/28/2017	DEPOSIT	100.00			
11/29/2017	DEPOSIT	100.00			
11/30/2017	DEPOSIT	100.00			
12/1/2017	DEPOSIT	100.00			
12/2/2017	DEPOSIT	100.00			
12/3/2017	DEPOSIT	100.00			
12/4/2017	DEPOSIT	100.00			
12/5/2017	DEPOSIT	100.00			
12/6/2017	DEPOSIT	100.00			
12/7/2017	DEPOSIT	100.00			
12/8/2017	DEPOSIT	100.00			
12/9/2017	DEPOSIT	100.00			

[illegible]

## Ephemeroptera

- Amelotidae  
Baetidae  
Baetiscidae  
Caenidae  
Ephemerellidae  
Ephemeridae  
Heptageniidae  
Isoneuridae  
Leptophlebiidae  
Oligoneuridae  
Polymitarcyidae  
Potamanthidae  
Siphonuridae  
Tricorythidae

DATE	DESCRIPTION	AMOUNT	CHECK NO.	BANK	INITIALS
10/1/78	DEPOSIT	100.00		CHASE	
10/2/78	PAYROLL	50.00	101	CHASE	
10/3/78	RENT	25.00	102	CHASE	
10/4/78	SALES	75.00	103	CHASE	
10/5/78	UTILITIES	15.00	104	CHASE	
10/6/78	DEPOSIT	120.00		CHASE	
10/7/78	PAYROLL	55.00	105	CHASE	
10/8/78	RENT	25.00	106	CHASE	
10/9/78	SALES	80.00	107	CHASE	
10/10/78	UTILITIES	15.00	108	CHASE	
10/11/78	DEPOSIT	110.00		CHASE	
10/12/78	PAYROLL	52.00	109	CHASE	
10/13/78	RENT	25.00	110	CHASE	
10/14/78	SALES	78.00	111	CHASE	
10/15/78	UTILITIES	15.00	112	CHASE	
10/16/78	DEPOSIT	115.00		CHASE	
10/17/78	PAYROLL	53.00	113	CHASE	
10/18/78	RENT	25.00	114	CHASE	
10/19/78	SALES	79.00	115	CHASE	
10/20/78	UTILITIES	15.00	116	CHASE	
10/21/78	DEPOSIT	118.00		CHASE	
10/22/78	PAYROLL	54.00	117	CHASE	
10/23/78	RENT	25.00	118	CHASE	
10/24/78	SALES	81.00	119	CHASE	
10/25/78	UTILITIES	15.00	120	CHASE	
10/26/78	DEPOSIT	122.00		CHASE	
10/27/78	PAYROLL	56.00	121	CHASE	
10/28/78	RENT	25.00	122	CHASE	
10/29/78	SALES	83.00	123	CHASE	
10/30/78	UTILITIES	15.00	124	CHASE	
10/31/78	DEPOSIT	125.00		CHASE	

[illegible]



Client	Red River Coal Company
Facility	BMI
Project Number	3886

Station ID	SFP-1
Stream Name	South Fork Pound
Sample Season	Spring 2012



#### Hemiptera

Belostomatidae  
Corixidae  
Gerridae  
Notonectidae  
Saldidae  
Veliidae



#### Lepidoptera

Cossidae  
Lepidoptera  
Noctuidae  
Pyralidae



#### Megaloidea

Corydalidae  
Sialidae



#### Odonata

Aeshnidae  
Calopterygidae  
Coenagrionidae  
Cordulegastridae  
Corduliidae  
Gomphidae  
Lestidae



#### Plecoptera

Capniidae  
Capniidae/Leuctridae  
Chloroperlidae  
Leuctridae  
Nemouridae  
Peltoperlidae  
Perlidae  
Perlodidae  
Pteronarcyidae  
Taeniopterygidae



<b>Station ID</b>	SFP-1
<b>Stream Name</b>	South Fork Pound
<b>Sample Season</b>	Spring 2012

1. ☒ **YES** - I have read and understand the terms and conditions of the license agreement. I agree to the terms and conditions of the license agreement.

Brachycentridae  
Calamoceratidae  
Glossosomatidae  
Helicopsychidae  
Hydropsychidae  
Hydroptilidae  
Lepidostomatidae  
Leptoceridae  
Limnephilidae  
Odontoceridae  
Philopotamidae  
Phryganeidae  
Polycentropodidae  
Psychomyiidae  
Rhyacophiloidae  
Talitridae  
Uenoidae

[illegible][illegible]

Amphipoda  
Ancyliidae  
Annelida  
Arachnida  
Axellidae  
Atractioidae  
Branchiobdellidae  
Cambaridae  
Collembola  
Corbiculidae  
Decapoda  
Gammaridae  
Gastropoda  
Hirudiniidae  
Hydrobiidae  
Hydracarina  
Isopoda  
Nematoda  
Nemertea  
Oligochaeta  
Pelecypoda  
Physidae  
Planariidae  
Planorbidae  
Pleuroceridae  
Sphaeriidae  
Tubellaria

[illegible][illegible]



## VSCI Benthic Macroinvertebrate Metric Spreadsheet

<b>Station ID</b>	SFP-2a
<b>Stream Name</b>	South Fork Pound
<b>Sample Season</b>	Spring 2012

[illegible][illegible][illegible][illegible]

DATE	DESCRIPTION	AMOUNT	BALANCE
1997-01-01	OPENING BALANCE		100.00
1997-01-05	PAYROLL	50.00	150.00
1997-01-10	RECEIVED	20.00	170.00
1997-01-15	PAYROLL	50.00	220.00
1997-01-20	RECEIVED	30.00	250.00
1997-01-25	PAYROLL	50.00	300.00
1997-02-01	CLOSING BALANCE		300.00

[illegible]

Client	Red River Coal Company
Facility	BMI
Project Number	3886

Station ID	SFP-2a
Stream Name	South Fork Pound
Sample Season	Spring 2012



#### Hemiptera

Belostomatidae  
Corixidae  
Gerridae  
Notonectidae  
Saldidae  
Veliidae



#### Lepidoptera

Cossidae  
Lepidoptera  
Noctuidae  
Pyralidae



#### Megaloidea

Corydalidae  
Sialidae



#### Odonata

Aeshnidae  
Calopterygidae  
Coenagrionidae  
Cordulegastridae  
Corduliidae  
Gomphidae  
Lestidae



#### Plecoptera

Capniidae  
Capniidae/Leuctridae  
Chloroperlidae  
Leuctridae  
Nemouridae  
Peltoperlidae  
Perlidae  
Perlodidae  
Pteronarcyidae  
Taeniopterygidae


4				4
4				4

A black and white photograph of a film strip. The strip is horizontal and shows several sprocket holes along its length. The image on the film is very dark and grainy, with some faint, illegible markings visible. The film strip is set against a dark background.

## Trichoptera

[illegible][illegible]**Other Taxes**[illegible][illegible]

[illegible]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
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## VASCI Benthic Macroinvertebrate Metric Spreadsheet

<b>Client</b>	Red River Coal Company
<b>Facility</b>	BMI
<b>Project Number</b>	3886

<b>Station ID</b>	SC-1
<b>Stream Name</b>	Short Creek
<b>Sample Season</b>	Spring 2012

## Coleoptera

- Carabidae  
Chrysomelidae  
Curculionidae  
Dryopidae  
Dytiscidae  
Elmidae  
Gyrinidae  
Haliplidae  
Hydraenidae  
Hydrophilidae  
Lampyridae  
Noteridae  
Psephenidae  
Ptilodactylidae  
Scirtidae  
Staphylinidae

[illegible][illegible]

## Diptera

- Athericidae  
Blephariceridae  
Ceratopogonidae  
Chaoboridae  
Chironomidae  
Culicidae  
Dixidae  
Dolichopodidae  
Empididae  
Ephydriidae  
Muscidae  
Phoridae  
Psychodidae  
Sciomyzidae  
Simuliidae  
Stratiomyiidae  
Syrphidae  
Tabanidae  
Tanyderidae  
Tipulidae

[illegible][illegible]

## Ephemeroptera

- Amelotidae  
Bactidae  
Bactiscidae  
Caenidae  
Ephemerellidae  
Ephemeridae  
Heptageniidae  
Isoneuridae  
Leptophlebiidae  
Oligoneuridae  
Polymitarcyidae  
Potamanthidae  
Siphonuridae  
Tricorythidae

Form 1041-SS (2019)			
Line	Amount	Amount	Amount
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<b>Client</b>	Red River Coal Company
<b>Facility</b>	BMI
<b>Project Number</b>	3886

<b>Station ID</b>	SC-1
<b>Stream Name</b>	Short Creek
<b>Sample Season</b>	Spring 2012



#### Hemiptera

Belostomatidae  
Corixidae  
Gerridae  
Notonectidae  
Saldidae  
Veliidae



#### Lepidoptera

Cossidae  
Lepidoptera  
Noctuidae  
Pyralidae



#### Megoptera

Corydalidae  
Sialidae



#### Odonata

Aeshnidae  
Calopterygidae  
Coenagrionidae  
Cordulegastridae  
Corduliidae  
Gomphidae  
Lestidae



#### Plecoptera

Capniidae  
Capniidae/Leuctridae  
Chloroperlidae  
Leuctridae  
Nemouridae  
Peltoperlidae  
Perlidae  
Perlodidae  
Pteronarcyidae  
Taeniopterygidae


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☒ I have read and understand the above information. I agree to the terms and conditions of the program.

**Trichoptera**

- Brachycentridae
- Calamoceratidae
- Glossosomatidae
- Helicopsychidae
- Hydropsychidae
- Hydroptilidae
- Lepidostomatidae
- Leptoceridae
- Limnephilidae
- Odontoceridae
- Philopotamidae
- Phryganeidae
- Polycentropodidae
- Psychomyiidae
- Rhyacophiloidea
- Talitridae
- Ucnoidae

[illegible]

**Other Taxa**

Amphipoda  
Ancyliidae  
Annelida  
Arachnida  
Asellidae  
Atractoideidae  
Branchiobdellidae  
Cambaridae  
Collembola  
Corbiculidae  
Decapoda  
Gammaridae  
Gastropoda  
Hirudinidae  
Hydrobiidae  
Hydracarina  
Isopoda  
Nematoda  
Nemerterea  
Oligochaeta  
Pelecypoda  
Physidae  
Planariidae  
Planorbidae  
Pleuroceridae  
Sphaeriidae  
Turbellaria

[illegible]

<b>Station ID</b>	SC-1
<b>Stream Name</b>	Short Creek
<b>Sample Season</b>	Spring 2012

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109.00	109.00
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6.00	6.00
0.00	0.00
15.60	15.60
0.00	0.00
72.48	72.48
81.65	81.65
5.22	5.22

Number of Taxa	45.45
Number of EPT Taxa	54.55
Percent E	0.00
Percent PT Less Hydropsychidae	43.81
Percent Scrapers	0.00
Percent Chironomidae	27.52
Percent Two Dominant	26.52
Hilsenhoff Biotic Index	70.29

Raw VASCI (Metric vs Standard)	33.52
Final VASCI (Metric Truncation 0-100)	33.52


109.00			109.00
0.00			0.00
14.68			14.68
1.83			1.83

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## VASCI Benthic Macroinvertebrate Metric Spreadsheet

<b>Client</b>	Red River Coal Company
<b>Facility</b>	BMI
<b>Project Number</b>	3886

<b>Station ID</b>	RC-1
<b>Stream Name</b>	Rat Creek
<b>Sample Season</b>	Spring 2012

## Coleoptera

- Carabidae  
Chrysomelidae  
Curculionidae  
Dryopidae  
Dytiscidae  
Elmidae  
Gyrinidae  
Halipidae  
Hydraenidae  
Hydrophilidae  
Lampyridae  
Noteridae  
Psephenidae  
Ptilodactylidae  
Scirtidae  
Staphylinidae

[illegible]

DATE	DESCRIPTION	AMOUNT	BALANCE
1960			
1961			
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## Diptera

- Athericidae  
Blaphariceridae  
Ceratopogonidae  
Chaoboridae  
Chironomidae  
Culicidae  
Dixidae  
Dolichopodidae  
Empididae  
Ephydriidae  
Muscidae  
Phoridae  
Psychodidae  
Sciomyzidae  
Simuliidae  
Stratiomyiidae  
Syrphidae  
Tanyderidae  
Tabanidae  
Tipulidae

DATE	DESCRIPTION	AMOUNT	CHECK NO.	BANK	INITIALS
10/1/19	DEPOSIT	100.00		CHASE	
10/2/19	DEPOSIT	100.00		CHASE	
10/3/19	DEPOSIT	100.00		CHASE	
10/4/19	DEPOSIT	100.00		CHASE	
10/5/19	DEPOSIT	100.00		CHASE	
10/6/19	DEPOSIT	100.00		CHASE	
10/7/19	DEPOSIT	100.00		CHASE	
10/8/19	DEPOSIT	100.00		CHASE	
10/9/19	DEPOSIT	100.00		CHASE	
10/10/19	DEPOSIT	100.00		CHASE	
10/11/19	DEPOSIT	100.00		CHASE	
10/12/19	DEPOSIT	100.00		CHASE	
10/13/19	DEPOSIT	100.00		CHASE	
10/14/19	DEPOSIT	100.00		CHASE	
10/15/19	DEPOSIT	100.00		CHASE	
10/16/19	DEPOSIT	100.00		CHASE	
10/17/19	DEPOSIT	100.00		CHASE	
10/18/19	DEPOSIT	100.00		CHASE	
10/19/19	DEPOSIT	100.00		CHASE	
10/20/19	DEPOSIT	100.00		CHASE	
10/21/19	DEPOSIT	100.00		CHASE	
10/22/19	DEPOSIT	100.00		CHASE	
10/23/19	DEPOSIT	100.00		CHASE	
10/24/19	DEPOSIT	100.00		CHASE	
10/25/19	DEPOSIT	100.00		CHASE	
10/26/19	DEPOSIT	100.00		CHASE	
10/27/19	DEPOSIT	100.00		CHASE	
10/28/19	DEPOSIT	100.00		CHASE	
10/29/19	DEPOSIT	100.00		CHASE	
10/30/19	DEPOSIT	100.00		CHASE	
10/31/19	DEPOSIT	100.00		CHASE	

[illegible]

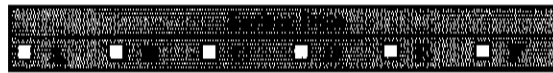
## Ephemeroptera

- Ameletidae  
 Baetidae  
 Baetiscidae  
 Caenidae  
 Ephemerellidae  
 Ephemeridae  
 Heptageniidae  
 Isonymchiidae  
 Leptophlebiidae  
 Oligoneuriidae  
 Polymitarcyidae  
 Potomanthidae  
 Siphoneuridae  
 Tricorythidae

[illegible][illegible]

Client	Red River Coal Company
Facility	BMI
Project Number	3886

Station ID	RC-1
Stream Name	Rat Creek
Sample Season	Spring 2012



#### Hemiptera

Belostomatidae  
Corixidae  
Gerridae  
Notonectidae  
Saldidae  
Veliidae



#### Lepidoptera

Cossidae  
Lepidoptera  
Noctuidae  
Pyralidae



#### Megalopectera

Corydalidae  
Sialidae



#### Odonata

Aeshnidae  
Calopterygidae  
Coenagrionidae  
Cordulegastridae  
Corduliidae  
Gomphidae  
Lestidae



#### Plecoptera

Capniidae  
Capniidae/Leuctridae  
Chloroperlidae  
Leuctridae  
Nemouridae  
Peltoperlidae  
Perlidae  
Perlodidae  
Pteronarcyidae  
Taeniopterygidae


1					1
1					1

Station ID	RC-1
Stream Name	Rat Creek
Sample Season	Spring 2012

1. ☒ I am a member of the National Association of Broadcasters (NAB) and I am submitting this statement in my capacity as a member.

Brachycentridae  
Calamoceratidae  
Glossosomatidae  
Helicopsychidae  
Hydropsychidae  
Hydroptilidae  
Lepidostomatidae  
Leptoceridae  
Limnephilidae  
Odontoceridae  
Philopotamidae  
Phryganeidae  
Polycentropodidae  
Psychomyiidae  
Rhyacophiloidea  
Trilutidae  
Uenoidae

[illegible]

Amphipoda  
Ancyliidae  
Annelida  
Arachnida  
Asellidae  
Atractideidae  
Branchiobdellidae  
Cambaridae  
Collembola  
Corbiculidae  
Decapoda  
Gammaridae  
Gastropoda  
Hirudinidae  
Hydrobiidae  
Hydracarina  
Isopoda  
Nematoda  
Nemertea  
Oligochaeta  
Pelecypoda  
Physidae  
Planariidae  
Planorbidae  
Pleuroceridae  
Sphaeriidae  
Turbellaria

[illegible]

[illegible][illegible]

Raw VASCI (Metric vs Standard)	17.06
Final VASCI (Metric Truncation 0-100)	17.06


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## VASCI Benthic Macroinvertebrate Metric Spreadsheet

<b>Station ID</b>	GF-1
<b>Stream Name</b>	Gladly Fork
<b>Sample Season</b>	Spring 2012

[illegible][illegible][illegible][illegible]

23		23
4		4
2		2

[illegible][illegible]



Client	Red River Coal Company
Facility	BMI
Project Number	3857

Station ID	GF-1
Stream Name	Gladys Fork
Sample Season	Spring 2012



#### Hemiptera

Belostomatidae  
Corixidae  
Gerridae  
Notonectidae  
Saldidae  
Veliidae



#### Lepidoptera

Cossidae  
Lepidoptera  
Noctuidae  
Pyralidae



#### Megalopectera

Corydalidae  
Sialidae



#### Odonata

Aeshnidae  
Calopterygidae  
Coenagrionidae  
Cordulegastridae  
Corduliidae  
Gomphidae  
Lestidae



#### Plecoptera

Capniidae  
Capniidae/Leuctridae  
Chloroperlidae  
Leuctridae  
Nemouridae  
Peltoperlidae  
Perlidae  
Perlodidae  
Pteronarcyidae  
Taeniopterygidae


5					5
72					72
1					1
2					2

<b>Station ID</b>	GF-1
<b>Stream Name</b>	Glady Fork
<b>Sample Season</b>	Spring 2012

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Brachycentridae  
Calamoceratidae  
Glossosomatidae  
Helicopsychidae  
Hydropsychidae  
Hydroptilidae  
Lepidostomatidae  
Leptoceridae  
Limnephilidae  
Odontoceridae  
Philopotamidae  
Phryganeidae  
Polycentropodidae  
Psychomyiidae  
Rhyacophiloidea  
Talitridae  
Uenoidae

2			2
2			2

Amphipoda  
Ancyliadac  
Annelida  
Arachnida  
Asellidae  
Atractiideidae  
Branchiobdellidae  
Cambaridae  
Collembola  
Corbiculidae  
Decapoda  
Gammaridae  
Gastropoda  
Hirudinidae  
Hydrobiidae  
Hydracarina  
Isopoda  
Nematoda  
Nemerterea  
Oligochaeta  
Pelecypoda  
Physidae  
Planariidae  
Planorbidae  
Pleuroceridae  
Sphaeriidae  
Turbellaria

[illegible]

Station ID	GF-1
Stream Name	Glady Fork
Sample Season	Spring 2012

[illegible][illegible][illegible]

117.00	117.00	117.00	117.00	117.00
12.00	12.00	12.00	12.00	12.00
8.00	8.00	8.00	8.00	8.00
2.56	2.56	2.56	2.56	2.56
70.09	70.09	70.09	70.09	70.09
0.00	0.00	0.00	0.00	0.00
19.66	19.66	19.66	19.66	19.66
81.20	81.20	81.20	81.20	81.20
3.03	3.03	3.03	3.03	3.03

Number of Taxa	54.55
Number of EPT Taxa	72.73
Percent E	4.18
Percent PT Less Hydropsychidae	196.87
Percent Scrapers	0.00
Percent Chironomidae	80.34
Percent Two Dominant	27.17
Hilsenhoff Biotic Index	102.44

Raw VASCI (Metric vs Standard)	67.28
Final VASCI (Metric Truncation 0-100)	54.87

[illegible]

117.00			117.00
2.56			2.56
68.38			68.38
3.42			3.42

[illegible][illegible]

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Stream: South Fork Pound Date: \_\_\_\_\_  
 Station: SFP-1  
 Description: \_\_\_\_\_  
 Time Begin: \_\_\_\_\_ Time End: \_\_\_\_\_ Meter Type: \_\_\_\_\_  
 Observers: \_\_\_\_\_ Stream Width\*: \_\_\_\_\_ Section Width (W): \_\_\_\_\_  
 Observations: \_\_\_\_\_

[illegible]



Stream: South Fork Road Date: 28 March 2012  
Station: SFP-2  
Description: \_\_\_\_\_  
Time Begin: \_\_\_\_\_ Time End: \_\_\_\_\_ Meter Type: \_\_\_\_\_  
Observers: TPT HV JK Stream Width\*: 17 Section Width (W): 1 Ft  
Observations: OK

[illegible]

[illegible]



Stream: Rat Creek Date: 28 March 2012  
Station: Rc-1  
Description: \_\_\_\_\_  
Time Begin: \_\_\_\_\_ Time End: \_\_\_\_\_ Meter Type: \_\_\_\_\_  
Observers: TPT HV JR Stream Width\*: 6.6 ft Section Width (W): 6 inches  
Observations: \_\_\_\_\_

[illegible]



Stream: Olady Fork Date: 28 MAR 12  
 Station: 6F-10  
 Description: \_\_\_\_\_  
 Time Begin: 10:30 Time End: 10:36 Meter Type: Global  
 Observers: \_\_\_\_\_ Stream Width\*: 14' Section Width (W): 1'  
 Observations: \_\_\_\_\_

[illegible]







## SAMPLE LOG SHEET &amp; CHAIN OF CUSTODY

LAB USE ONLY

COC No.:

DATE RECEIVED LAB:

CUSTOMER INFORMATION: Shaded Areas • LAB INFORMATION: White Areas

**ENVIRONMENTAL MONITORING, INCORPORATED**  
 ENVIRONMENTAL CONSULTANTS & ANALYTICAL LABORATORIES  
 P.O. Box 1190 • Norton, Virginia 24273 • 276-679-6544

CLIENT:

Red River (col)

CONTACT:

BILLING ADDRESS:

## Required Information

\* COLLECTED BY (print)

COLLECTOR(S) SIGNATURE(S)

TURN-AROUND (circle):

 2 Day (Working Days)  
 5 Day (Working Days)  
 10 Day (Working Days)  
 Regular (15 Working Days)

Additional Cost May Apply - Any TAT Not Specified Will Be Regular

SITE ID: SEP

CLIENT PROJ. NO.

EMI PROJECT NO.: RSP

Special Instructions / QC Requirements &amp; Comments

EPA SAMPLING

EMI No. EMI SAMPLE #

CUSTOMER SAMPLE IDENTIFICATION

DATE COLLECTED

TIME COLLECTED

SAMPLE No. of MATRIX CHITS

SFP-1

28 March 1300

AQ 8

## PARAMETER (ANALYSIS REQUESTED)

PARAMETER (ANALYSIS REQUESTED)	DATE	TIME	LOCATION	ANALYST	REMARKS
MISC. 500					
TOTAL METALS					
ARSENIC					
CHLORIDE					
DISSOLVED					
ORGANIC METALS					
PHENOL					
SYNTHETIC					
0.1550000					
METALS					
EPA 0702 CDD					
PIT					
Flow					

## PRESERVATIVE USED:

H<sub>2</sub>O<sub>2</sub>

NaOH

HCl

HNO<sub>3</sub>

COOL

A 600

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

X

STATE/ZIP

PHONE ( )

FAX ( )

Purchase Order No.

 SAMPLES WILL BE DISPOSED  
 OF IN ACCORDANCE WITH  
 EMI'S TERMS & CONDITIONS  
 OR RETURNED TO CLIENT OR  
 Archive for \_\_\_\_\_ months

REMARKS

A HOLD DISSOLVED

METALS FOR FUTURE

ANALYSIS

A NO DISSOLVED

METALS COLLECTED

QA Review:

Anomaly Report Required:

Report to be sent (if different than customer information):

NAME:

ADDRESS:

CITY:

STATE/ZIP:

FAX ( )

Temperature of Cooler upon Receipt by Lab

20

Additional Remarks:

Customer to complete all shaded categories, use additional forms if necessary

METHOD OF SHIPMENT TO LAB (circle)

US MAIL

UPS

FEDEX

EM-DIRECT

EM PICKUP

PERSONAL DELIVERY

OTHER







Log Sheet of

# SAMPLE LOG SHEET & CHAIN OF CUSTODY

LAB USE ONLY

COC No.:

DATE RECEIVED LAB:

**ENVIRONMENTAL MONITORING, INCORPORATED**  
ENVIRONMENTAL CONSULTANTS & ANALYTICAL LABORATORIES  
P.O. Box 1190 • Norton, Virginia 24273 • 276-879-8544

## Required Information

\* COLLECTED BY (print)

COLLECTOR(S) SIGNATURE(S)

TURNOVER (circle):

2 Day

3 Day

5 Day

10 Day

Regular

(Working Days) (Working Days) (Working Days) (Working Days) (Working Days) (15 Working Days)

Additional Cost May Apply - Any TAT Not Specified Will Be Regular

\* SITE ID: SFP-2

CLIENT PROJ. NO.:

EMI PROJECT MANAGER

RSP

Special Instructions / QC Requirements & Comments

EPA SAMPLING

EMI NO. EMI SAMPLE #

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

CUSTOMER INFORMATION: Shaded Areas • LAB INFORMATION: White Areas

CLIENT: Red River Coal

BILLING ADDRESS

\* CONTACT:

CITY:

STATE/ZIP

PHONE ( )

FAX ( )

Purchase Order No.:

SAMPLES WILL BE DISPOSED OF IN ACCORDANCE WITH EMI'S TERMS & CONDITIONS OR RETURNED TO CLIENT OR Archive for \_\_\_\_\_ months

REMARKS

1. A HOLD DISPOSED

2. METALS FOR FUTURE ANALYSIS

3. A NO DISPOSED

4. METALS COLLECTED

5.

6.

7.

8.

9.

10.

QA Review:

Anomaly Report Required:

Report to be sent (if different than customer information):

NAME:

ADDRESS:

CITY:

STATE/ZIP:

FAX ( )

Temperature of Cooler upon Receipt by Lab

20C

Additional Remarks:

Customer to complete all shaded categories, use additional forms if necessary

US MAIL UPS FED. EX. EMI-DIRECT EMI PICKUP PERSONAL DELIVERY OTHER

EMI PROJECT MANAGER

RSP

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8

DATE COLLECTED

TIME COLLECTED

SAMPLE NO. OF MATRIX CONTS

28 MAR 12 1052 AQ 8